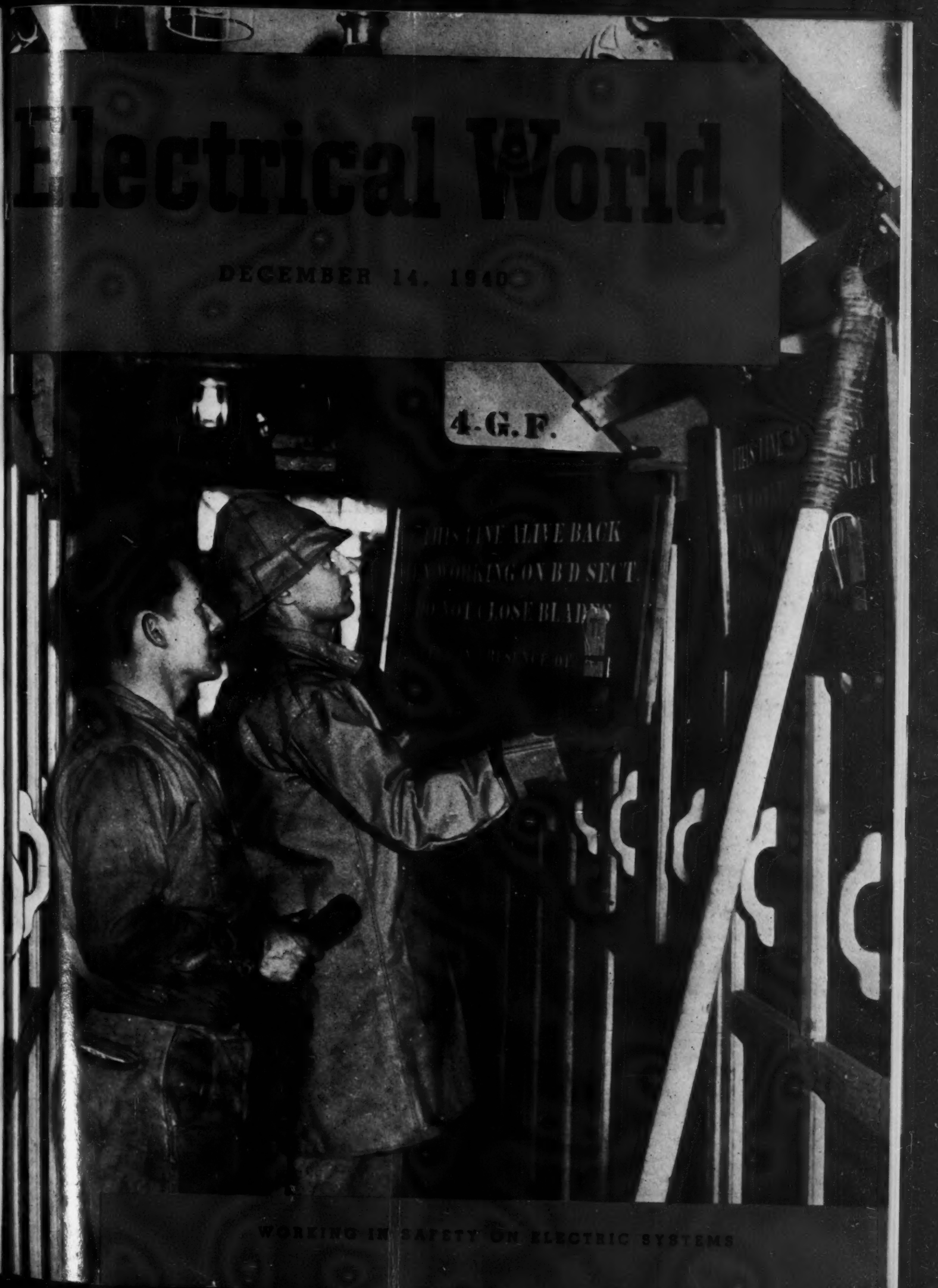
Electrical World

DECEMBER 14, 1940



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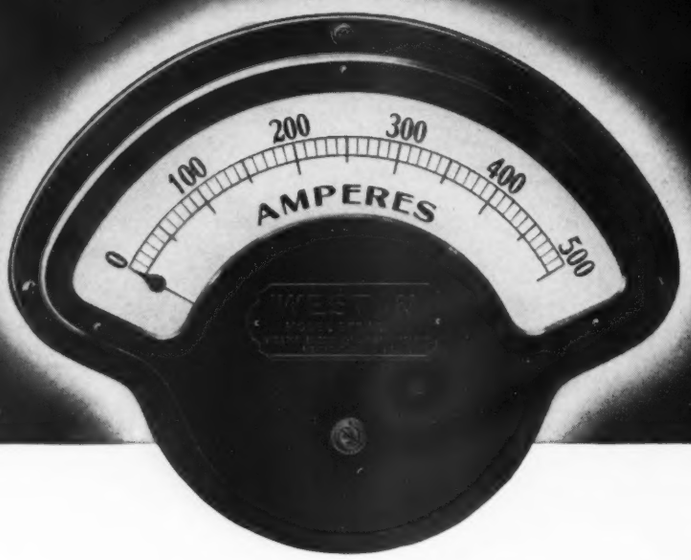

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December 14, 1940

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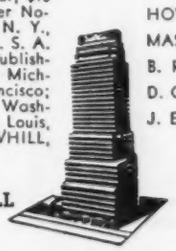

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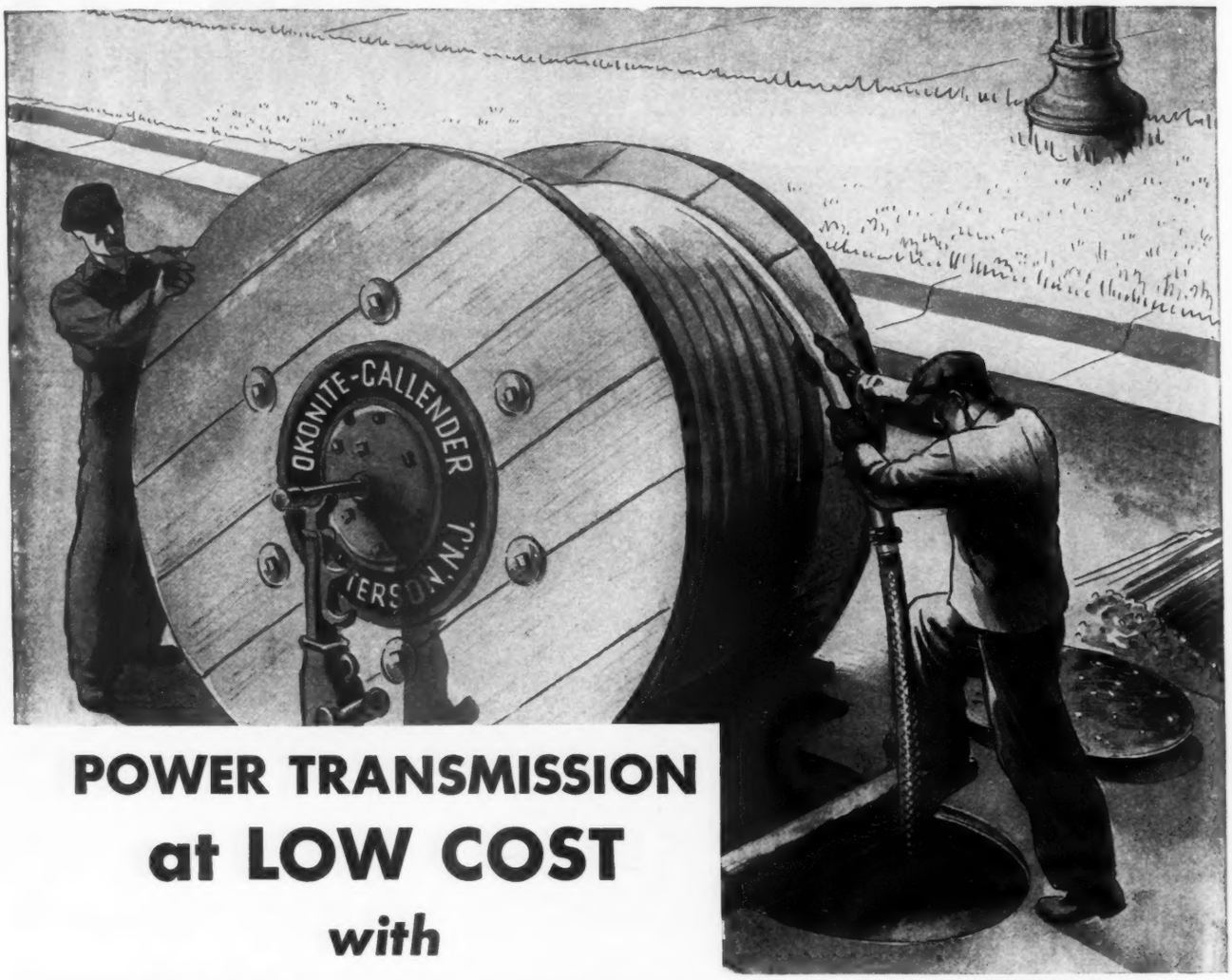

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Interchangeability

Standardization has been criticised at times as an impediment to progress. Whatever justification there may be for that point of view, it must be admitted that certain kinds of standardization have resulted in progress in other directions that have far outweighed any advantage that might have resulted from multiformity of design.

How much progress, for instance, would have taken place in lighting if we had not standardized on the Edison screw base for lamps? How far along would electric service be in this country were it not for a standard 60-cycle supply? How rapidly would the appliance market have grown were it not for the standard plug and receptacle?

This standardization, which makes it possible for the customer to use his equipment anywhere, has unquestionably been effective in raising the individual usage of current to world-high levels.

Interchangeability which characterizes this type of standardization has removed many sources of customer irritation, and in so doing has not only improved customer relations and made buying easier, but has decreased the cost of customer service.

All of this leads us to urge that no backward step be taken in tamper-proof fuses, which, according to the new 1940 National Electrical Code, will be mandatory for new work on November 1. Last December, when the electrical committee, N.F.P.A., revised the Code, interchangeability was made a recommendation only. To try to bring about standardization, however, a special committee was set up. A year has gone by and the committee appears to have had small success so far in achieving its goal.

Nor are eleven months left in which to secure a standard. Manufacturers of other equipment, such as panelboards and entrance devices, as well as contractors and engineers, must be prepared.

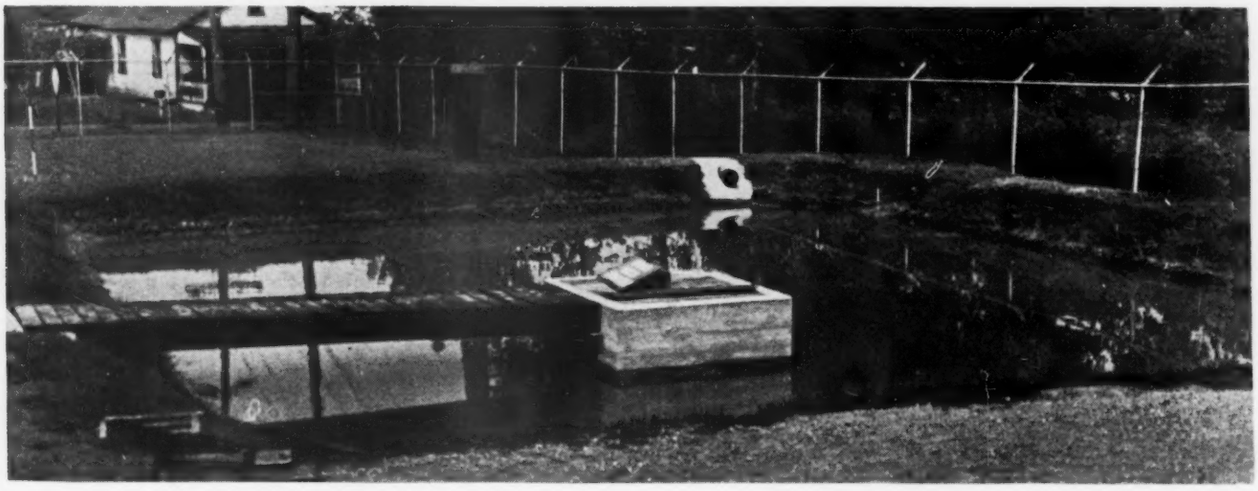
If, when November first rolls along and the new fuse rule is enforced, the devices available are not interchangeable, there will arise from the confusion hazards which will be worse than those the new Code is trying to correct. Customers will not be without light just because their type of fuse is not available. Not only that, but the irritation of the customers will work to the disadvantage of the utilities, contractors and to the fuse manufacturers as well. In fact, because of the resistance of the utilities and the public, we doubt very much if any non-tamperable fuse rule can be enforced if the fuses are not interchangeable.

We cannot believe, however, that the fuse manufacturers are willing to incur the ill will of the public and of the utilities and thus endanger their own market. In spite of what might seem like an impasse at the moment, we are confident that reasonable standards acceptable to all can and will be worked out.

Pump Pond Water Spray to Quench Substation Fires

Unique method provides water supply for fixed spray for nozzles arranged about three banks of 66/13-kv. transformers — Includes water storage pond, gasoline-driven pump and Siamese connection for fire department

P. J. ZERBE, Philadelphia Electric Company*



POND of 50,000 gal. capacity is 39x46x6 ft. with sloping sides. It is lined with a 12-in. blanket of clay and is fed by springs on the plot sufficient to offset seepage and evaporation. A well offers a supplementary source in dry weather. Screens are housed in the concrete structure in the center; bridge provided for access to clean the screens

A FIXED SYSTEM of water spray for extinguishing oil fires on two 10,000-kva. and one 15,000-kva., 66/13.2-kv. transformer banks at the Newlinville substation of the Philadelphia Electric Company was recently installed and successfully tested.

Newlinville substation is located outside the city limts of Coatesville, Pa., and receives energy at 66 kv., transforming it to 13.2 kv. and 33 kv. for distribution to the surrounding territory. Fixed protection was considered desirable in order to permit the single attendant immediately to start extinguishing a possible transformer oil fire. The nearest organized fire company is located ½ mile away and, being a volunteer company, considerable delay might be experienced in the response to a call, especially during the night hours.

The nearest available water supply is from the mains of the Coatesville Water Company, which terminate approximately 1,600 ft. from our substation. However, the volume and pressure were found inadequate for our requirements. Consideration was given to the installation of a gravity tank and also pressure tanks. However, each required a well and pump for the water supply, together with provisions to prevent freezing in winter. The volume of water available with these schemes was considered insufficient for our needs.

A 14-in. pipe was installed from the screened suction intake in the pond to a suction well located adjacent to the pumps, a distance of approximately 75 ft. Screens were provided at the pond to exclude foreign substances being drawn into the pumps. Separate suction pipes are installed from the well to each pump. The pipes are provided with individual foot valves to hold water in the pipe and pump casing and thus insure the pumps being primed at all times.

Two 750-gal. centrifugal type fire pumps, each directly connected to a 95-hp. gasoline engine, are installed in the building, arranged for parallel operation and designed to furnish 1,500 gal. of water per minute at 90 lb. pressure. Gasoline-driven pumps were selected so that power will be available for use in event of a complete electrical outage of the substation. The fuel supply is obtained from a 75-gal. storage tank buried outdoors, in conformity with state regulations.

As an added precaution, a Siamese fire department pumper connection was provided to permit the local fire companies to attach to and furnish water pressure in event that our pumps might be inoperative or to

*Engineer, electrical engineering division.

furnish water from the nearest water hydrant, about 1,600 ft. away, in the event that our pond was empty.

The transformers having fixed protection are located in the 66-kv. yard, which is situated approximately 30 ft. above the pond water level.

Tests Successful

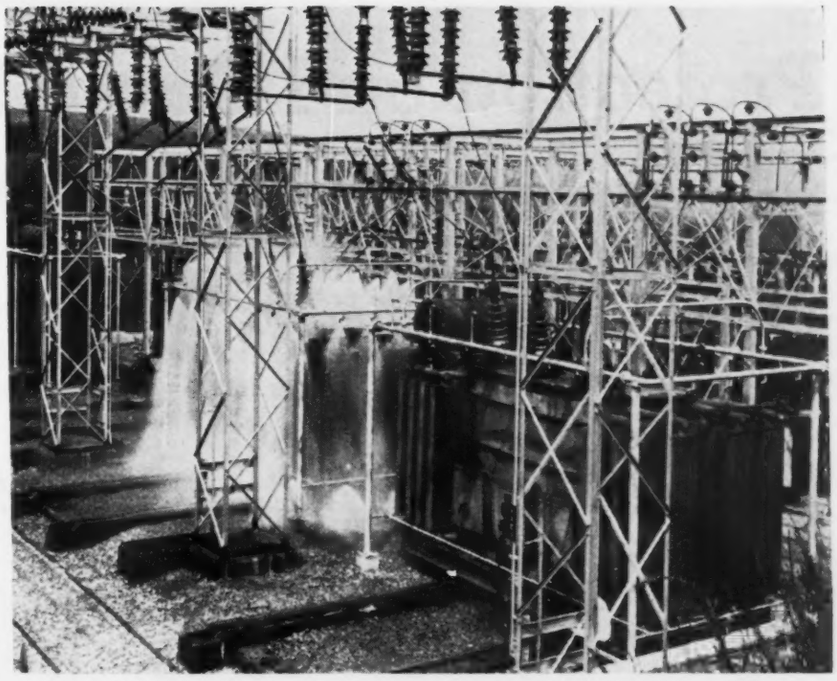
During tests of the installation with one pump operating, the flow pressure at the pump was 75 lb. and the flow pressure at the projectors of No. 3 bank was 55 lb. With both pumps operating the pressures were 100 lb. and 95 lb. respectively. With one pump operating on No. 4 bank the flow pressure at the pump was 50 lb. and at the transformer 25 lb., and with both pumps the pressures increased to 125 lb. and 85 lb. respectively. With both pumps operating and water being discharged on Nos. 2 and 3 banks simultaneously the pressure at the pumps was 75 lb. and at the transformers 65 lb.

During an impromptu test to determine the time required from receipt of alarm until water could be discharged on a particular bank it was found that fifteen seconds after the operator received the call he had the fire pumps in operation, 40 seconds later the proper gate valve was opened and five seconds later full spray was on the transformer, making the total lapsed time one minute.

Hose hydrants have been provided at two locations to which portable hose and nozzles can be attached for attacking ground fires outside the area of the fixed protection and for general use throughout the substation.

The 50,000-gal. pond provides sufficient water to furnish a 40-minute supply to the largest system, which is bank No. 4, requiring 1,250 gal. Assuming the pond to be covered with 12 in. of ice in the winter, there would still be a 30-minute supply for the larger system. For the smaller banks, requiring 850 gal., there is available in summer 60 minutes' supply and in winter 40 minutes. During tests conducted in 1936 transformer oil fires were extinguished in less than ten seconds.

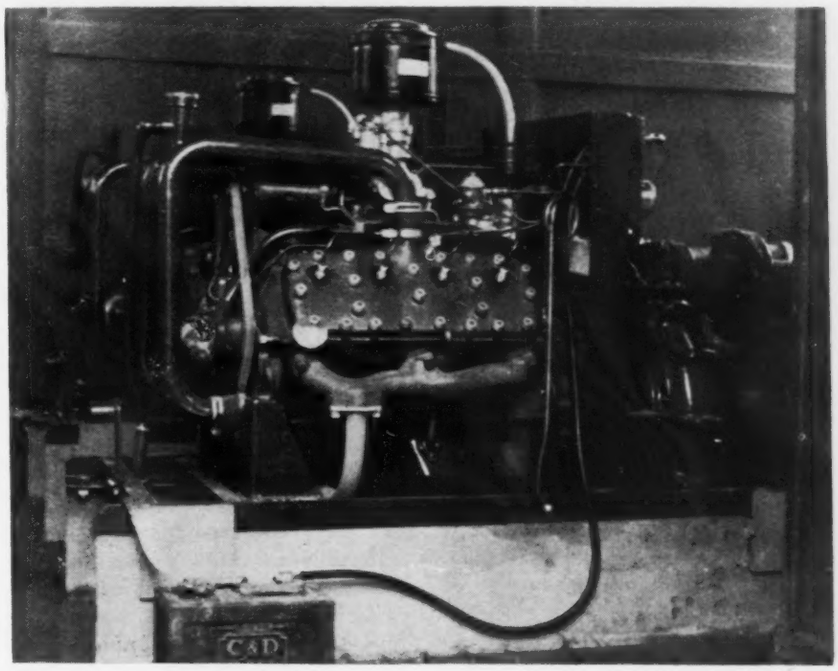
For auxiliary protection $1\frac{1}{2}$-in. portable hoses are provided. The summer storage capacity is sufficient to operate two of these for approximately $3\frac{1}{2}$ hours and in winter $2\frac{1}{2}$ hours. The gasoline storage capacity is sufficient to keep both pumps operating continuously for five hours.



THREE BANKS equipped with spray nozzles, one battery in operation on 10,000-kva. bank. Each spray group is controlled by separate manually operated gate valve located at a safe distance from the transformers. Bank in foreground is a second 10,000-kva. bank also requiring 850 gal. of water per minute. Bank in background comprises three 5,000-kva. units requiring 1,250 gallons per minute.

All pipes between the pond and the manually-operated gate valves are buried below the frost line and will normally be filled with water. The pipes from the gate valves to the transformers will be normally dry and are partly buried and partly exposed.

The estimated costs of the storage pond were less than the alternatives considered and from our viewpoint the pond is more desirable. The pump capacity is large enough to provide protection for larger apparatus in the future.

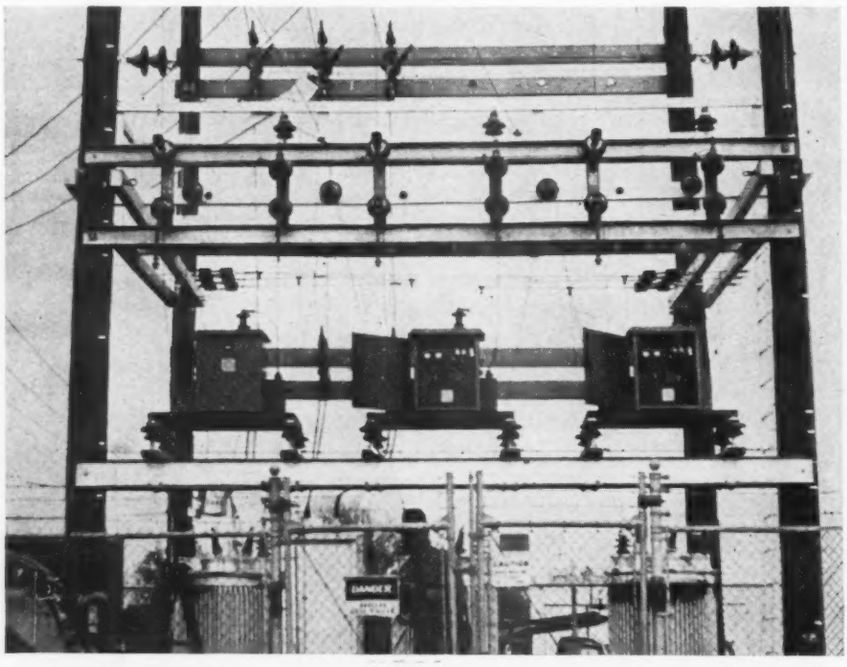


TWO 750-gallon-per-minute fire pumps provide 90-lb. pressure. Each is driven by a 95-hp. gasoline engine. Each pump is equipped with ejector, which can be operated by the motor exhaust to permit priming the pumps in case of failure of the foot valves to hold properly

Protection and Control of the Series Capacitor

Shunting out, gapping and overvoltage limitation are available for protection against abnormal current or dielectric failure — Transformer step-up for low working voltages

W. H. CUTTINO, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*



OVERVOLTAGE DEVICE may be mounted on insulating platform directly with the series capacitors at the substation

WHEN A CAPACITOR is placed in series with the line the voltage developed across its terminals is dependent upon the capacitance ohms and the current flowing beyond it. In this connection there are usually four conditions that must be considered if capacitors are applied with voltage ratings which are very little in excess of their normal working voltage. These are as follows:

(a) Full load current.

(b) Momentary overload current such as occurs during motor starting condition.

(c) Continuous overload current.

(d) Maximum short-circuit current.

Series capacitors are rated for a normal continuous current that will give the rated working voltage across the capacitor terminals. This working voltage would agree with the rating of a capacitor for shunt applications. Shunt capacitors are allowed a maximum continuous voltage of 15 per cent above the rated voltage. It is desirable, therefore, to prevent the operation of the series capacitor continuously at more than 115 per cent of its current rating.

It is permissible for the voltage across the capacitor terminals to reach a momentary maximum voltage during motor starting of 150 per cent of normal rated voltage. The protective device should, therefore, permit the capacitor to operate for a few minutes over the range of 115 to 150 per cent for motor-starting currents.

Short Circuit Protection

The capacitor must be shunted out in case of a short circuit on the line. A protective device used for protecting the capacitor during short circuits on the line should be one that is extremely fast and should be capable of handling the current for the duration of the fault. No mechanically operated switch is fast enough to protect the capacitor for the first cycle or two, therefore some kind of a gap arrangement is required to give the fast protection in the order of microseconds that will not permit the peak voltage on the capacitor to exceed between two and two and a half times its normal rated voltage. A switch may be associated with the gap to bypass it and relieve it from carrying the short-circuit current after the first few cycles, or a line breaker may be caused to open the circuit if the breaker is located near by.

In addition to the above it is usually desirable on large series capacitor installations to shunt out the capacitor in case of a dielectric failure in any one of the individual capacitor units until the damaged unit is located and replaced. This is to avoid the possibility of other capacitor units being damaged and to permit continuity of service. Insulation in any electrical apparatus is subject to failure, however remote.

* Capacitor engineer.

If a shunt capacitor fails the fuse blows or the breaker opens. If a series capacitor fails the current remains substantially the same as before and the fault in the capacitor unit may continue to arc due to reclearing of the fault. This might continue for a long time or the fault might develop into a solid short circuit in the unit, if the fault contact is capable of carrying the total line current, in which case the arcing stops. If the current is less than 25 amp. there is a good possibility of a solid short developing in the faulty capacitor.

Large series capacitors can be supplied with the capacitor units mounted in a housing complete with overload and dielectric failure protection. This protection scheme is described in the March, 1936, *Electric Journal* under the subject of series capacitors, but is not economically justified except on very large installations.

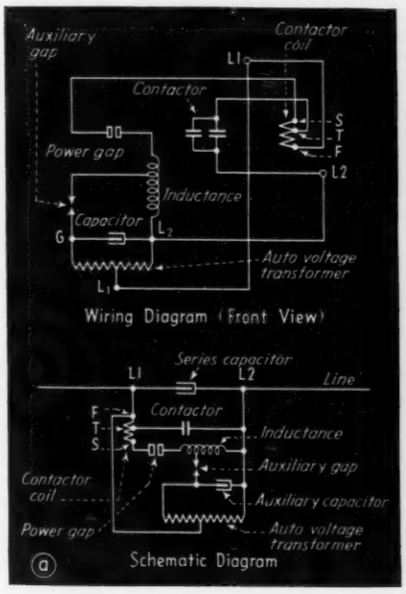
The question may be raised as to the possibility of using a metal coordinating gap for protecting the series capacitor from overvoltage. In the first place the conventional metal gaps are not dependable at low voltages such as are encountered in the majority of series capacitor applications. Furthermore, such a gap results in oscillation peaks of high amplitude and burning of the gap takes place with each operation, reducing the protection obtained.

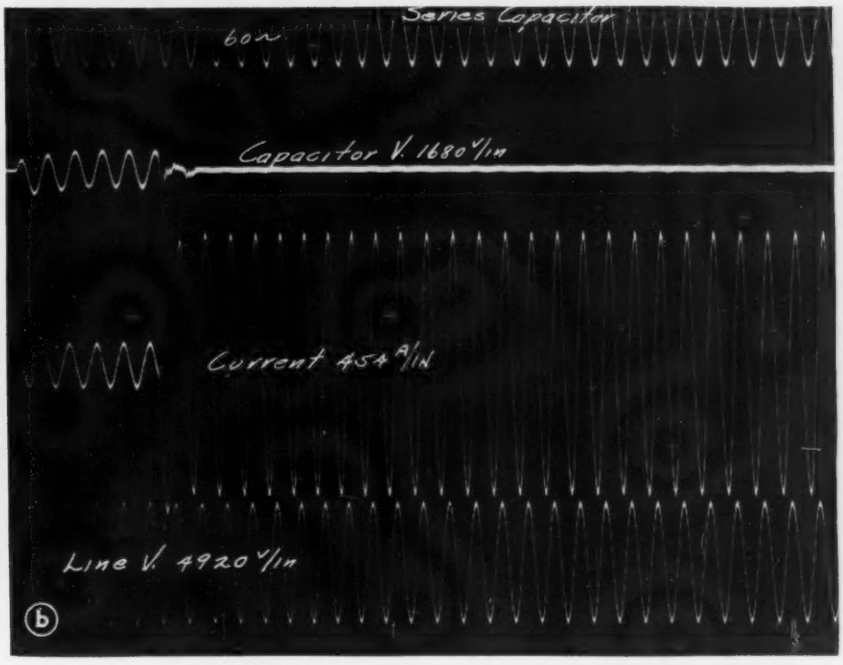
Small series capacitors with simple protection against short-circuit damage only may be considered for circuits with limited short-circuit current and where the actual load conditions can be accurately predicted. This consists of outdoor capacitor units of suitable rating mounted on insulators, together with a cabinet inclosing an overvoltage limiting device for each phase. The protective device is connected in shunt to positively limit the voltage across the capacitor terminals in case of short-circuit current.

If the capacitors are insulated from ground as well as the line itself, no extra lightning arresters are needed. The capacitors offer very low impedance to the high-frequency surges between terminals resulting from lightning and are, therefore, self-protecting between terminals.

Lightning arresters are recommended, connected line to ground for transformer-connected series capacitors or on large series capacitor installations where current transformers are inserted in the line to obtain overload protection.

Lightning arresters are not suitable



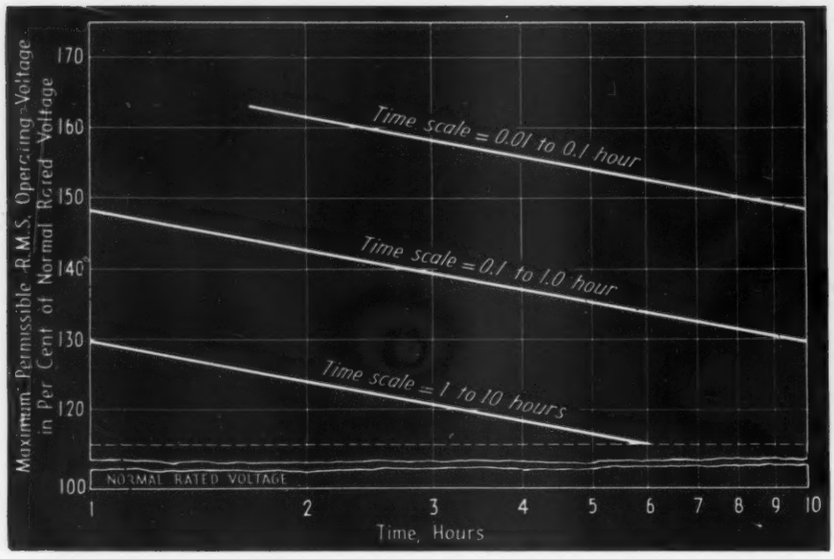


(a) Voltage drop across the series capacitor L-1 to L-2 induces a certain voltage across high-voltage winding of small auto-transformer, keeping small auxiliary capacitor charged to voltage of approximately 4,000 r.m.s. when normal rated current is flowing in line. Auxiliary gap is set to breakdown at approximately 8,000 volts, therefore, should the voltage double across series capacitor, auxiliary gap will break down, thus discharging auxiliary capacitor through part of inductance coil shown, producing a high-frequency oscillating circuit. This raises the potential across the power gap to superimposed high-frequency voltage, causing sparks to jump across and ionize this gap.

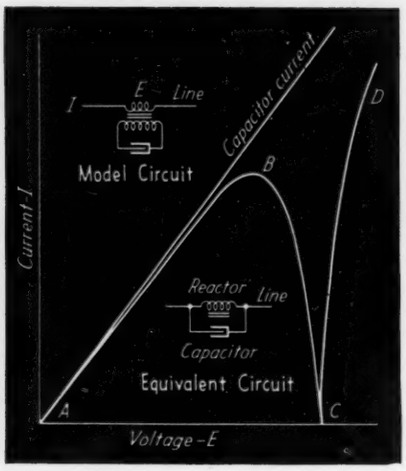
Upon ionization of the power gap there is immediate power follow current, thus shunting series capacitor, bringing voltage down to 40 or 50, which is arc drop across power gap. Auxiliary gap ceases to arc, since voltage on primary of transformer has dropped to a low value. Power current, however, passes through contactor-closing coil, which closes contactor, shunting both series capacitor and power gap. Closing of the contactor places only the holding coil on the contactor in the circuit. Holding coil is designed for a definite dropout, so that when the line current drops to normal value contactor will open, restoring series capacitor to service. Two protector devices available are for maximum working currents of 50 amp. and 100 amp. The 50-amp. rating has maximum permissible short-circuit current rating of 300 amp. for ten seconds and the 100-amp. rating has maximum permissible short-circuit current rating of 600 amp. for ten seconds.

(b) Protective device is fast in operation. Voltage across the capacitor and the current through the capacitor are shown at the left side of the film. At a certain point the current was increased several times. It will be noted that the maximum capacitor voltage was approximately double and during the period of time equal to about ½ cycle, the voltage across the series capacitor is represented by the arc drop of the power gap, after which the contactor closes, reducing to zero the series capacitor voltage. It will be noted that the contactor goes in very fast. This is partly due to the d.c. component furnished by the capacitor.

CIRCUIT DIAGRAM and functioning of voltage-limiting device



PERMISSIBLE short-time maximum operating voltage for series capacitors — Curves are for type FP Inerteen capacitors following no load or full load and at rated ambient working temperature for the unit



"Jumping phenomenon" of ferro-resonance must be avoided in transformer-coupled series capacitor

As the voltage E is increased the current I follows the line AB with values which are a function of the capacitor current component plus the transformer exciting current component. The total current reaches a maximum B. In the region A to B the current is practically all capacitor current and leading. As the voltage E is further increased, the current decreases along the curve BC. Beyond C the current increases and the exciting current predominates and the total current is lagging. Over the range A to B the conditions are entirely stable. Beyond B there is a danger of sudden increases in current, shifting the operation over to the curve CD. Once on curve CD it is necessary to drop the current down to a fairly low value to return to curve ABC. The shifting from a point on the curve BC to a point on the curve CD is known as the "jumping phenomenon" of ferro-resonance.

for 60-cycle overvoltage protection between terminals of series capacitors. Lightning arresters are not designed to carry 60-cycle power current. In fact, they are designed to limit the power current to 20 or 30 amp. at rated 60-cycle voltage so that the arrester will interrupt power follow current in ½ cycle or less when the arrester operates due to an impulse surge. The thermal capacity of lightning arresters is designed on the basis of carrying power follow current for only ½ cycle or less, and would be damaged if subjected to 60-cycle overvoltage of much greater duration than ½ cycle. A protective device for a series capacitor must carry power current, in case of overvoltage between terminals, until the overload or short circuit on the line is removed or the line fuses or circuit breaker opens the circuit. Therefore, it is evident that a lightning arrester is not suitable for such an application.

If a capacitor is placed in series in a circuit, the voltage for which the capacitor should be insulated between terminals depends upon the voltage that can be developed under load or short-circuit conditions. The maximum permissible short-time operating voltage for standard Inerteen capacitors is shown in an accompanying illustration. It should be kept in mind that adding the series capacitor increases the maximum possible short-circuit current. Roughly, the cost of a capacitor of a given ohmic rating varies as the square of the voltage rating, excluding the 230-volt capacitor, which costs much more per kva. It is, therefore, usually much more economical to use an overvoltage protective device and use capacitors with voltage ratings which are very little in excess of their normal working voltage.

Unprotected Series Capacitors

There are possibly cases where it would be economical to apply capacitors without overvoltage protection and with a certain margin of over-insulation. For example, a 460-volt capacitor might be located in the neutral or ground lead ahead of a small single-phase, 2,300/115-volt distribution transformer where the possibility of a short circuit between the capacitor and transformer would be very remote and where the capacitor would normally be working, say, at 230 volts, and a short circuit on the low-voltage side of the transformer would not likely result in more than about four times rated current, or 920 volts on a 460-volt capacitor.

It must be remembered in applying capacitors in series with a distribution circuit that the insulation to ground should be co-ordinated with the other insulation on the line. Since the line-to-ground voltage is usually much higher than the terminal-to-terminal voltage rating of the capacitor, this can be accomplished by mounting standard capacitors on insulators which meet the requirements of the line, or in some cases special capacitors can be built with the required insulation between terminals and case. For example, a 230-volt capacitor could be built with a standard 2,300-volt insulation to ground, such as 2,300-volt terminal bushings and 2,300-volt insulation between capacitor element and case. It is usually cheaper to mount the capacitors on insulators. In some cases it may be possible to place the capacitor in series with each transformer to neutral on a wye-connected bank of distribution transformers and thus eliminate line-to-ground insulation.

If the working voltage on a series capacitor is very low, say 100 volts or less, it is usually economical to use a series transformer to step up the voltage to permit the use of standard voltage rating capacitors of 460 volts or above. The design of the series transformer should be very carefully considered in order to prevent the possibility of the "jumping phenomenon" of ferro-resonance.

Boiler Circulation, Settings and Water Focus of A.S.M.E.

Power sessions indicate the use of forced circulation, light metal settings and silica-free feedwater as significant developments in the boiler art

HIGH-PRESSURE high-temperature steam equipment was accorded much attention at the power sessions of the annual convention of the American Society of Mechanical Engineers in New York last week. Deduction could be drawn that the art of steam generation is at the point of transition from natural to forced circulation for large capacity units as typified by the Montaup Electric Company's Somerset station (see ELECTRICAL WORLD November 30, 1940) Another prophecy was that tight metallic shells for boiler settings would not only be conducive to outdoor installations but also project a trend toward positive pressure in combustion chambers. A third arena of steam explored was the control of silica in boiler waters and turbine steam.

On circulation it was not so much the Van Brunt (Combustion Engineering) paper reporting on a study of circulation in high-pressure boilers and water-cooled furnaces as it was Eric Leib's mathematical supplement which provoked the sentiment that the potentialities of natural circulation have been largely exhausted and forced circulation is in prospect, particularly for low-height steam generators. The latter set up a long series of equations from which one can deduce the conditions tantamount to instability of flow in down-comers, risers and water-wall tubes. His formidable formulas prompted several remarks to the effect that it was disturbing to learn, after years of semi-bliss with natural circulation, that the phenomenon is so intricate.

Density difference in down-comers and risers when diminished by the pressure drop factors result roughly in half the height of a 1,350-lb. boiler being available for circulating head if the water-steam mixture has a 5/1 ratio and heat absorption in the risers is considered uniform over its length. Van Brunt concluded that circulation is readily made adequate for maximum load and substantial margin rendered available for overload. Increase in down-comer areas was advocated as the move to make if exaction calls for reduction of flow losses to render the available circulating head adequate. There is a lower limit of boiler height at which the dryness factor at the top of risers would approach unity, circulation would cease and the evaporating tubes fail from overheating. It was admitted that natural circulation may therefore become inadequate in high-capacity boilers of low height.

In Condensers, Too

That this matter of instability of flow is not confined to boilers was brought out in one discussion which cited two metropolitan-area condensers of foreign make that exhibited reverse flow in some tubes of the first pass. Tube failure is to be expected in the region of no circulation in any form of heat exchanger and therefore flow stability is to be accorded more careful attention.

Both Alex Bailey (Commonwealth Edison) and Irving Moultrop (Boston Edison, retired) interpreted the Van Brunt presentation as an acknowledgement by boiler manufacturers that current designs are approaching the limits of natural circulation. M. D. Engel (Boston Edison) ventured the suggestion that we may as well adopt forced circulation if we have to acknowledge uncertainty about the further possibilities and the limitations of natural circulation. Moultrop had previously pointed out that forced circulation gives far greater assurance that flow will everywhere be in the desired direction and volume with minimum risk of reversals, no no-flow points and far less risk of burned tubes.

Problem of Auxiliaries

On the other hand, the Navy was reported to have found little advantage for marine application and considerable hesitancy to place dependence on the auxiliaries required for forced circulation.

Success with natural circulation depends, in the estimation of M. H. Kuhner (Riley Stoker Corp.), on control of the losses in head due to turbulence at entrance and exit points of tubes where they enter headers or drums. To minimize this turbulence it is desirable to have headers fairly large relative to tubes and tubes uniformly spaced along with more generous sizing of all parts involved in unimpeded flow. Buoyancy effect of steam bubbles that may be generated in down-comer pipes dictates the avoidance of heat application to the down-comers in an effort to maintain maximum circulation and dryness at riser tops. That the effective circulating head may be less than any of Van Brunt's assumptions, due to difference in velocity effects of the saturated water in the down-comers and in the risers with water-steam mixtures, was the opinion of E. G. Bailey of Babcock & Wilcox.

Another phase of forced circulation, this time in very small steam generators, appeared in the descrip-

tion of a new reciprocating engine and associated boiler for reversing steam-excavating equipment by Messrs. Knox and Yellott. The unit gives promise of offering competition to electric drives for this service. The prime mover is a high-speed, three-cylinder, balanced, compound, uniflow engine with reversal effected by reversal of steam flow and equal cut-off and expansion for either direction of rotation. Steam consumption on test at 70 hp. (75 per cent loading) was 14.6 lb. per hp.-hour, non-condensing, with an engine efficiency of 53.3 per cent. The engine weighs 450 lb.; *i.e.*, 5 lb. per brake-horsepower. The valves reciprocate and also rotate slightly. The engine has high torque at low speeds.

The associated boiler is a compact (60x36x38 in.) forced-circulation unit capable of a heat release of 400,000 B.t.u. per cu.ft. per hour. The design presents a half-pound of boiler weight per pound of 700 psi., 750 F. steam per hour. Combustion air is fed between outer and inner shells and this keeps the outer surface comfortably cool. The circulating impeller extends the whole length of the lower drum, a distance of 4½ ft. Domestic oil was used in the tests, but heavier oil is deemed wholly practicable.

Advantages of a boiler with two furnaces instead of one were cited by Blizard and Foster (both Foster-Wheeler) as affording a lower furnace-exit-gas temperature for the same rate of heat liberation per unit of furnace volume. Also, when a radiant superheater is installed in one of the two furnaces, the final temperature of the steam may be controlled over a wide range of steaming by proper adjustment of the rate of firing in both furnaces.

Twin Furnace Experience

For the Ohio Power 750,000-lb.-per-hour boiler at Power, W. Va., of two-furnace design, it was shown that final temperature remains practically constant at 925 F. over a 325,000 to 750,000-lb-per-hour steaming rate.

Tight settings as a prerequisite for the boilers of the future were emphasized in a paper by M. H. Kuhner, of Riley Stoker Corporation. Out of the paper and its discussion came several significant points. One was a prophecy that the trend will be toward pressure combustion and that this will necessitate tight settings. The steel-encased setting is conducive to outdoor installations which save the cost of a structure and the general adoption of waterwalls is conducive to the adoption of metal settings. Another aspect of the situation as to air infiltration through brick or refractory settings is the dilemma of the boiler-furnace manufacturer in striving to meet the demand for less infiltration on the one hand and the demand of insurance interests for greater area of explosion vents. Provision of vents in any such ratio as 1 sq.ft. for each 100 cu.ft. of furnace volume is inimical to the objective of a tight setting.

The waterwall is what has made the steel casing feasible, said George Daniels (Commonwealth & Southern). Steel, he felt, is not practicable outside of brick settings, his experience being that both are subject to burning even with plenty of infiltration. Suspended sidewalls also show a tendency to be burned unless considerable leakage is tolerated.

Silica Removal

Chemistry of silica removal from high-pressure boiler waters won attention in two separate sessions. Harold Farmer, chief chemist, Philadelphia Electric Company, in an introductory paper said that tube failures had occurred with silica concentration lower than 20 ppm. Many operators were setting a value of 12 ppm. based roughly on five complete boiler-contents evaporations per hour and with only 0.1 ppm. of silica in the (good condensate) feedwater. Frequent blowing down is not, he said, looked upon with favor by operators of high-pressure boilers even as a means of holding down silica concentration. He emphasized that the chemical analyses generally give only total silica and make no distinction between the five or more different possible forms. X-ray diffraction analysis is being used successfully to identify the various components of boiler scale and sludge. Poor circulation was stated to accentuate the troubles from silica carry-over into superheater and turbine flooding.

A process for removal of silica which lends itself to a modified Spaulding precipitator at either low or high temperature, to be followed by suitable treatment with carbonaceous ion exchangers for reduction of residual hardness and alkalinity, was described by Howard L. Tiger, vice-president Permutit Company. The process is an ionic magnesia treatment and for any given set of conditions the ionic Mg precipitate as $Mg(OH)_2$ is most efficient. However, undissolved magnesium compounds also give satisfactory results under favorable conditions.

An adsorption process was described by L. Drew Betz of W. H. & L. D. Betz of Philadelphia. He showed magnesia to be particularly efficient in removal of soluble silica with resulting decrease in solids content of treated water.

Waterside Zeo-Karb

At Waterside No. 2 (Consolidated Edison) is the largest Zeo-Karb (Permutit) feedwater treating system ever built and it is also the first installation for pretreating make-up for boilers at 1,250 psi. supplying superposed turbines and district steam. After a year of operation, during which the only water supplied to the high-pressure boilers was condensate from the low-pressure turbines and Permutit-treated Croton water, the internal inspection of the boilers shows a uniform good condition. Economizers, too, are free of deposits and corrosion. Maintenance of the treatment plant has been negligible. No operating problems have arisen in connection with the handling of the acids and salts.

Croton supply could not be used unsoftened in the high-pressure plant because its bicarbonate hardness would cause ultimate formation of scale in stage heaters, piping and economizers and problems within the boiler would be aggravated. On the basis of thermal economy, degasification, treating costs and installation convenience, a cold water carbonaceous zeolite treating system was deemed preferable. With no return condensate from the steam used for district heating, the water softening capacity had to equal or exceed the quantity of steam used for that purpose.

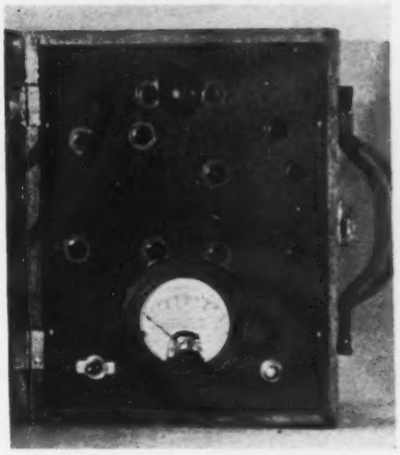
The requisites of the system were set forth thus:

1. Practically complete removal of calcium and magnesium scale-forming salts from the make-up water.

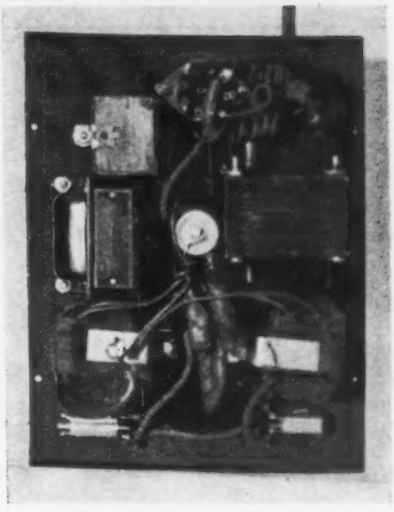
[*Continued on page 136*]

Voltmeter with Filter Locates Flicker Remedy

Brute-force filter segregates critical frequency phenomena—application focuses on the cure among house wiring, service, secondary and transformer impedance



W. R. WEISE,* Cincinnati Gas & Electric Company



PORTABLE flicker voltmeter (10 x 8½ x 4½ in.) constructed with standard radio parts is a valuable addition to the complaint inspector's test equipment

VISUAL PERCEPTION of flicker is most keen at about six impulses per second, at which frequency a ¾-volt pulsation in supply voltage produces considerable nervous discomfort. Modern distribution systems must be designed to confine cyclic and non-cyclic flicker within the accepted limits of good service.

An inexpensive meter can be constructed to read accurately flicker voltage by using a standard voltmeter of the rectifier type and a suitable filter circuit. The meter shown in the accompanying illustration was constructed for about $35 and has proved indispensable for complete and comprehensive analysis of voltage problems caused by electric refrigerators, air conditioners, air compressors, amateur C.W. transmitters, butt, flash and spot welders, seam welders with interrupters, etc.

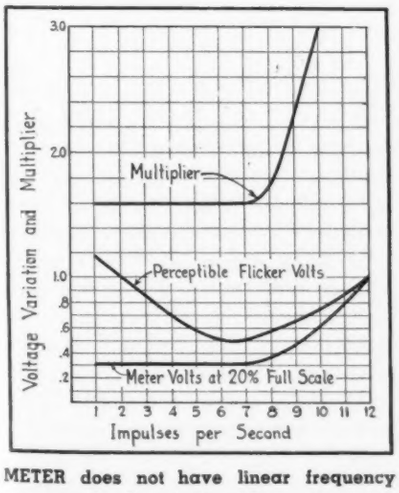
A brute-force filter circuit can be assembled from standard radio parts that will offer infinite attenuation to the 60-cycle voltage and at the same time pass the lower frequency pulsations up to about twelve impulses per second. Voltage changes caused by inrush currents and power pulsations on the supply lines are passed through the filter into a sensitive indicating meter through a condenser which blocks the higher voltage rectified supply voltage and permits the meter to read only the desired voltage change.

The circuit provides for (1) amplification of the pulsating 60-cycle voltage to about 3½ times input voltage, (2) rectification of the amplified voltage, (3) a filter circuit to attenuate the 120-cycle and pass the lower frequencies, (4) a load resistor, (5) a non-polarized coupling condenser, (6) a sensitive rectifier type meter, (7) a shorting switch to protect the meter when the coupling condenser charges or discharges as the meter is plugged in or removed from the line. When the filter is used with an oscillograph element the best results are obtained by nulling the d.c. output of the filter with batteries and a potentiometer. The filter circuit will respond to half-cycle impulses and is equally effective on either voltage increment or decrement.

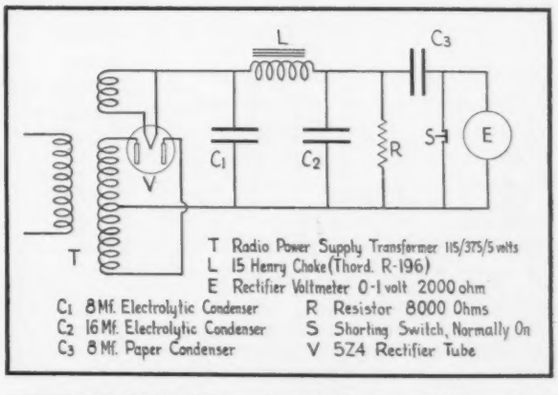
The calibration curve illustrates the sensitivity of the indicating model. It can be seen that 20 per cent of full

[*Continued on page 142*]

*Voltage control engineer.



METER does not have linear frequency response for frequencies above seven per second, but is so sensitive that voltage variations below visual perception can be easily read on 0-1 volt scale



BRUTE-FORCE FILTER and method of coupling to indicating voltmeter. More stages can be used in the filter, but the additional chokes attenuate the lower frequency impulses

Adopt Unit Substations for Industrial Service

Five unit installations in textile plant save expense of large substation structures, valuable floor space in plant and long low-voltage bus runs — Equipment features flexibility and interchangeability

A. W. FRANKENFIELD, E. I. du Pont de Nemours & Co., Inc., and W. A. HOLLAND,† General Electric Co.*

SMALL-CAPACITY unit substations, consisting of a transformer with the necessary switchgear and control accessories for transformer and feeders, all built together into a completely metal-inclosed assemblage, have established their values to electric utilities for urban and suburban distribution.

That these units are equally applicable to industrial plants is shown by the installation at the Nylon textile plant of E. I. du Pont de Nemours & Company, Inc., at Seaford, Del., where five are used. The desirable installation and operating features achieved in this industrial electrical system by the use of unit substations may thus be summarized:

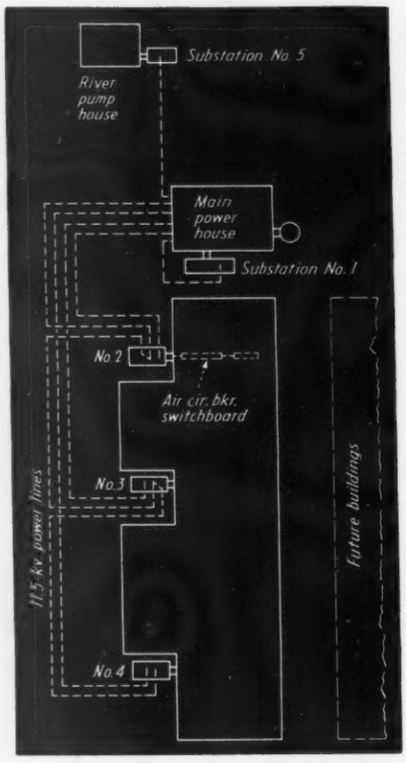
1. They are installed at centers of load demand, where cable runs are short.

2. Because extensive engineering and planning are not necessary and the equipment is self-contained, little time is required for installation.

3. Beginning with small units, substation capacity can be added in small increments as required, saving fixed charges on the unused capacity of larger units, or on large substations located away from load centers.

4. One cannot always foresee exact factory load conditions and here the unit substation is a help. It can be moved from place to place if changes in load conditions become sufficiently great to require it.

5. A number of small unit substations offer a high degree of over-all service reliability. Since each serves a relatively small load, outages of any of its elements involve the dropping of a relatively small amount of load.



PLANT LAYOUT achieves continuity and reliability of service through independent 11.5-kv. underground cables to five substations located at load centers of different processing departments of plant. Second line from power house interconnects substations 2, 3 and 4

6. Excellent voltage regulation can be obtained by means of the ratio-control equipment on the transformer, insuring the greatest economy in regulating equipment.

7. The metal inclosure provides a feature particularly desirable in the industrial plant, with the elimination of accidental contact with live parts, the assurance of safety to personnel and protection to the inclosed equipment.

8. Because of standardization of units, additional unit substations can be purchased economically in simple transactions based on definite costs, without involved engineering studies, plant layouts or additional building structures.

In this plant, as in most industrial plants, continuity and reliability of service are of prime importance. So the five unit substations are supplied by underground 11.5-kv. cables, to assure freedom from lightning disturbances and high-voltage surges. There is an independent feeder line to each substation and, in addition, to avoid shut-down, a second line from the power house interconnects substations 2, 3 and 4, serving as an emergency incoming line should the independent line be put out of service.

As one aid to service reliability in this plant, all units are entirely interchangeable. In substations 1, 2, 3 and 4 the transformers are the same. Each transformer is a three-winding unit rated 4,500-kva., three-phase, with a 2,300-volt secondary of 50 per cent rating and a 460-volt tertiary of 75 per cent rating. These secondary and tertiary ratings permit greater flexibility of application, such as a fifty-fifty per cent division of the load, or 25 per cent, 2,300-volt load and 75 per cent, 460-volt, depending upon the load demand. In substation 5 the transformer is a 3,000-kva., two-winding unit, not having a 460-volt tertiary, but even here the unit is contained in a tank that is the same

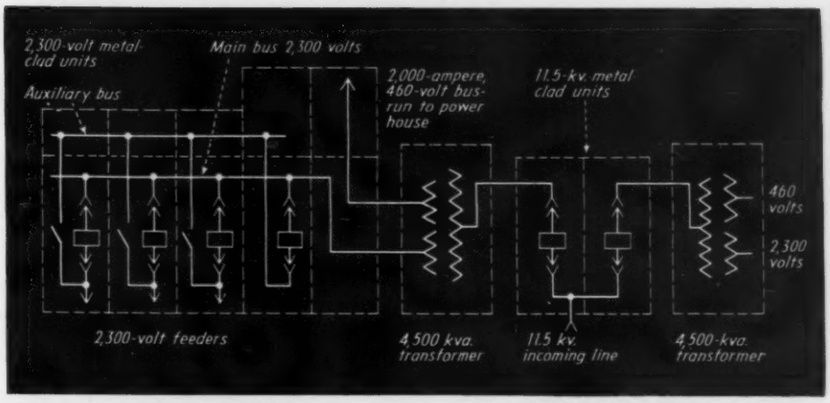
* Electrical design division. † Switchgear division.

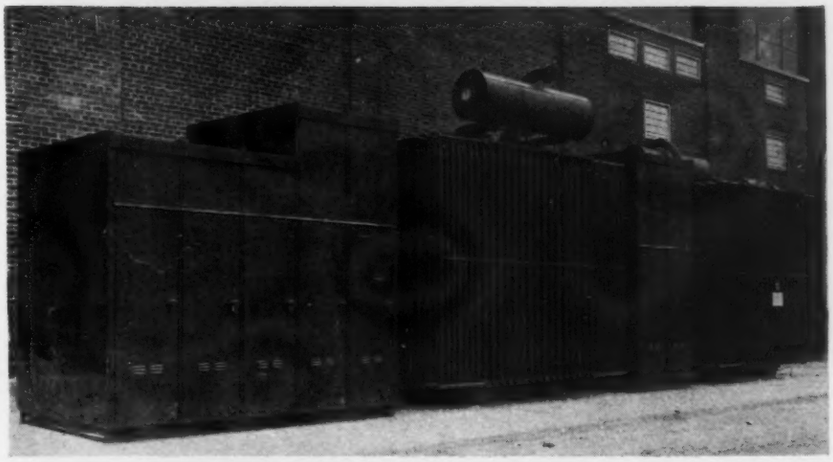
size as, and interchangeable with, the 4,500-kva. units in the other stations. In substation No. 1, in addition, there is an extra transformer which is simply a standby spare, kept connected and excited continuously so as to be dry and always ready for instant utilization.

Another contribution to continuity of service is the facility of removing and replacing equipment. Oil circuit breakers for the 11.5-kv. supply and the 2,300-volt feeder circuits are rated 15 kv., 600 amp. and in all cases are duplicate and interchangeable. Thus one or two breakers could serve the entire plant adequately and, like the transformer, in cases of emergency the breakers could be withdrawn from a substation of lesser importance—during the emergency—and moved to the point of greater need.

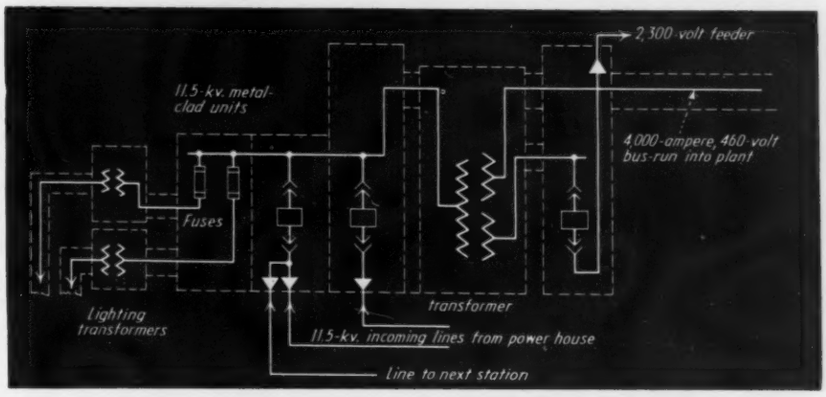
Each breaker is mounted in a metal-clad switchgear unit with vertical-lift elevating and lowering mechanism. This provides an easy and ready means for removal and replacement of the breaker, so that in times of breaker inspection and adjustment there is no need for a prolonged shutdown. Within a few seconds the breaker can be lowered and removed, a spare inserted and elevated and service resumed. Moreover, the breaker thus removed from the live circuit is transported to a safe, convenient and comfortable location where it can be inspected, tested and adjusted in a thorough manner, without hurry and without fear of contact with live parts. A "double-deck" transfer truck facilitates this breaker removal and replacement.

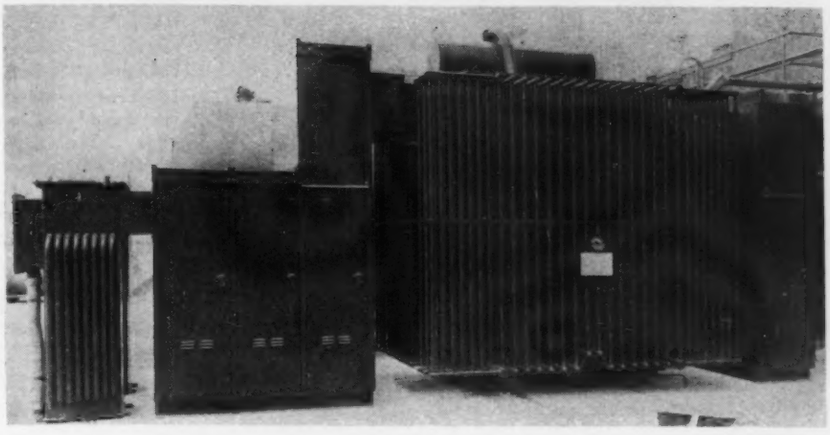
Mechanical interlocks are provided so that it is impossible either to lower



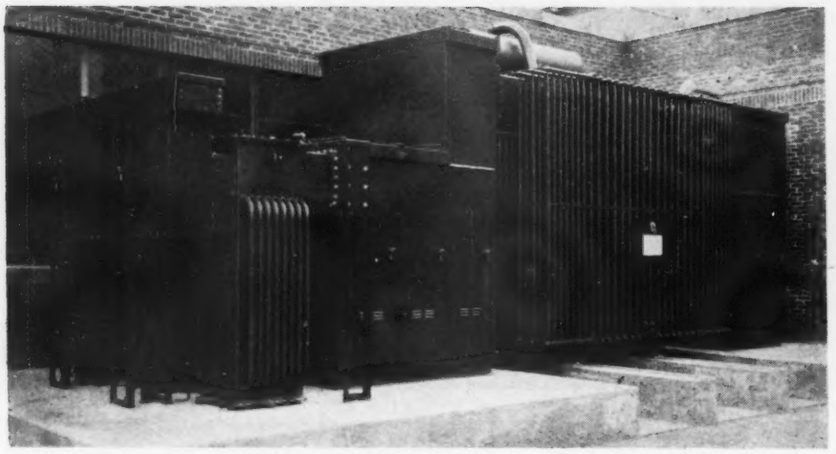


SUBSTATION NO. 1 supplies power for auxiliaries of the main power house. It consists of two 4,500-kva., 11,500- to 2,300- to 460-volt, three-phase, 60 cycle transformers (one spare), two 11.5-kv. metal-clad incoming line units, four 2,300-volt metal-clad feeder units and a 2,000-amp., 460-volt bus run directly into the power house

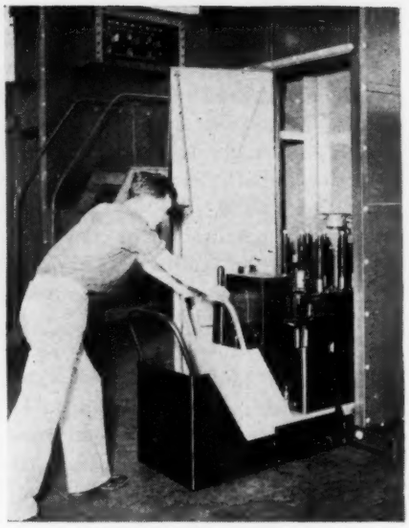




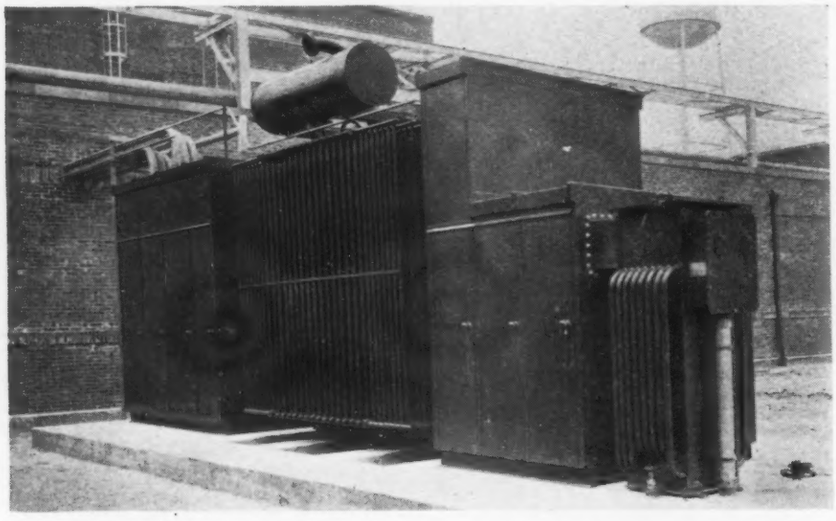
SUBSTATION NO. 2, with its one 4,500-kva., 11,500/2,300/460-volt transformer and metal-clad switchgear, is located adjacent to the textile plant. Switchgear consists of three 11.5-kv. units, one a fuse compartment for the two 150-kva., 11,500- to 230/115-volt, single-phase, 60-cycle lighting transformers at left-hand end of structure, and two controlling incoming lines. A 2,300-volt feeder unit is at right and a 4,000-amp., 460-volt, metal-clad bus run goes from the right end of the structure into a drawout air circuit breaker distribution board and motor control board within the factory.



SUBSTATION NO. 3 is similar to substation No. 2 but has three of the 150-kva., single-phase lighting transformers. It also has a 4,000-amp., 460-volt bus run directly into the plant



DUAL TRANSFER TRUCK simplifies circuit breaker removal, transfer and replacement



SUBSTATION NO. 4 is the same as No. 2 in its 11.5-kv. side, except that only one of the ultimate two 150-kva. lighting transformers is shown in place. On the low-voltage side this substation differs from Nos. 2 and 3 in that the 460-volt power is led into two metal-clad compartments (at far left), each containing three drawout air circuit breakers. Six 460-volt feeder conduits can be seen at the top of this structure

SUBSTATION NO. 5 supplies 2,300-volt power to the river pump house. It consists of one 3,000-kva., 11,500- to 2,300-volt, three-phase, 60-cycle power transformer, one 11.5-kv. metal-clad incoming-line unit, 1,200-amp., 2,300-volt bus directly into pump house and three 15-kva., 2,300- to 460-/230-volt, single-phase, power and lighting transformers

the breaker from its operating position (for removal) or to raise it into its operating position (in replacement) unless the breaker is open. This insures that the circuit will be properly interrupted always by the breaker and avoids any possibility of opening, or attempting to open, the circuit, or of drawing an arc, on the external studs or on the disconnecting device contacts.

Another item of flexibility is the choice of methods of circuit breaker control. In substation No. 1 the breakers are electrically operated with dual sources of control, (a) from the main switchboard inside the power house and (b) from control switches on the control panel inside each metal-clad unit. Thus, by means of signal lights, the power house operator knows at all times which breakers are closed and under his immediate control is the ability to open or to close any of the breakers.

The breakers in the other substations (both the 11.5-kv. and 2,300-volt oil circuit breakers and the 460-volt air circuit breakers) in this plant are arranged only for manual closing, but all are equipped for automatic tripping on overcurrent or short circuit. Even with the electrical and manual operation of the oil circuit breakers, however, the interchangeability of breakers is not interfered with. An electrically operated breaker can be inserted in place of a manually operated breaker, or a manually operated in place of an electrically operated easily and immediately. The electrically operated breaker has provision for manual operation, but, of course, the manually operated cannot be operated from a remote point.

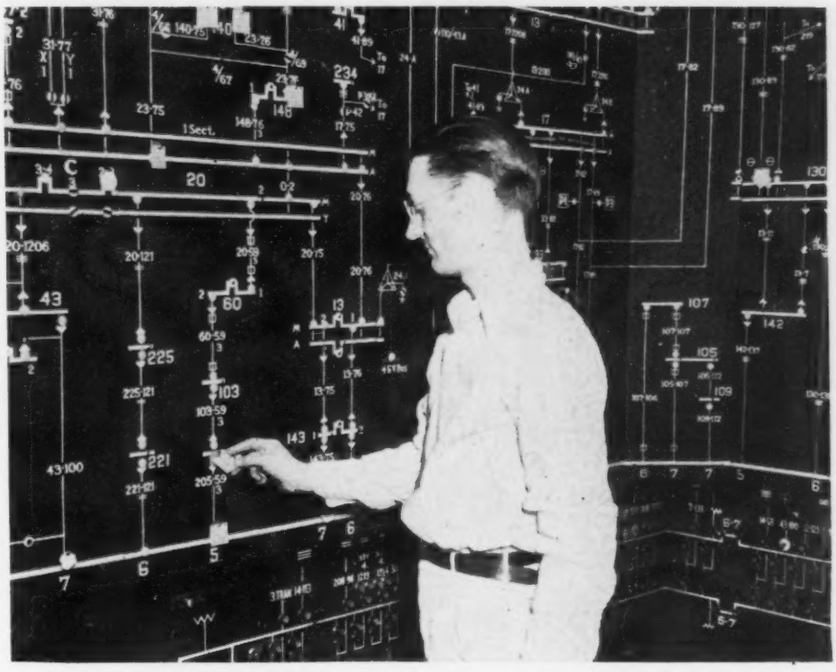
1.3 Million Man-Hours of Safety

Electrical group at Boston Edison's L Street station handle routine and construction tasks through eleven-year period without lost-time accident — Preventive methods outlined

HENRY R. KURTH, Boston Edison Company

SAFETY MEASURES developed over an extended period by the Boston Edison Company bore fruit in the rebuilding of the switch house at its L Street generating station, when during two years no injury occurred to any workman from electrical causes, no serious injury from mechanical causes and this with no loss of service to any customer. Moreover, the last lost-time accident to any of the forty-odd men comprising the operating and electrical repair organizations at L Street occurred March 1, 1929. In these more than eleven years the number of man-hours worked without loss of time by accident has passed 1,300,000.

Such a record could not have been attained with an indifferent attitude toward safety. The precautionary measures taken are typified in the illustrations accompanying this article, and it is interesting to note that the safety rules and practices existing when the recent work at L Street was begun required but little extension to cope with the situations which developed during the reconstruction of the switch house to meet the increased responsibilities imposed on this plant.



PORTION of system dispatcher's diagram board with clerk tagging 205-59 line. Other lines which have been tagged for various purposes are indicated.

First and Foremost

Prior to each step in the reconstruction program conferences were held between the engineering and operating organizations to establish a common thought on the work planned and to foresee the necessary safety precautions. This included the important practice of submitting construction blueprints to the operating department for suggestions before beginning the work in the station.

The general line of procedure in connection with the removal of apparatus from service is shown herewith. The proper removal of equipment from duty is the first and most important consideration from the operating standpoint. This may involve the operation of several oil circuit breakers and eighteen disconnecting switches for a single transmission line, or as many as 400 disconnects for two entire bus sections (mainly 13.8 kv.) which must be opened and closed during a working day. Such wholesale switching has a tendency to make an operator function mechanically, and continual checking and supervision are therefore necessary to avoid the errors that often creep into familiar routine.

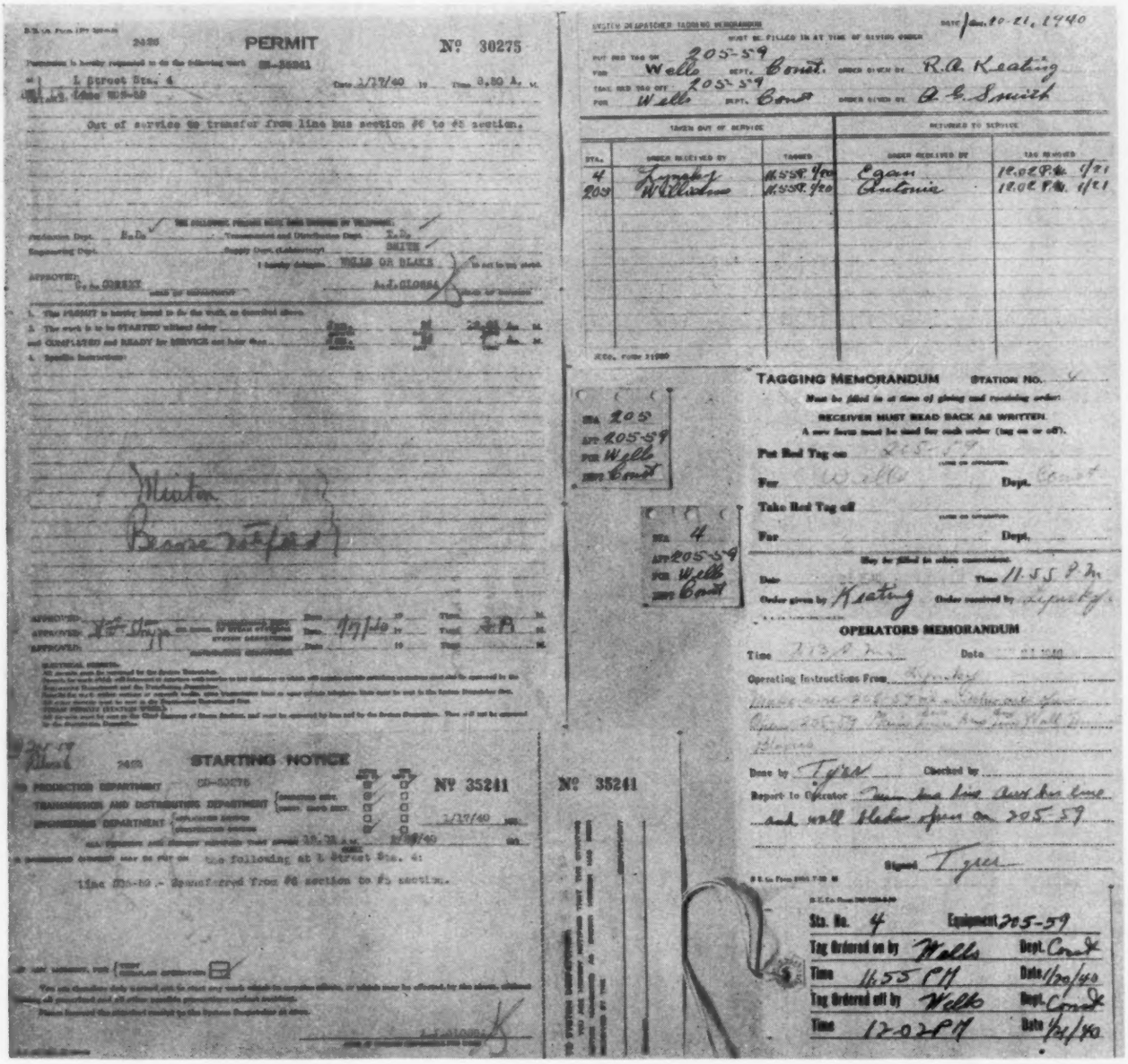
Continuous Supervision

These examples of operating practice typify our approach toward safety, but no ritual remains effective without continuous supervision and instruction. It has been our experience that of all the measures used in accident prevention, this supervision

of both construction and operating work is by far the most important. By assigning a competent supervisor to watch the movements of a small group of workmen when in proximity to live equipment the maximum assurance of safety is provided.

This supervisor has no other duties, remains continually and actively in full view of the workmen and, when necessary, issues warnings, provides added barriers and stops work entirely if it appears that adequate safety cannot be assured. In the case of L Street, this active supervision has been carried out by both the construction inspection staff and the operating division staff, to provide complete coverage of the various working forces.

The operating division supervisor also checks each step in the preparation of buses and apparatus for the work, verifying the dead condition of the equipment at all points where it is exposed by the removal of barriers. He further checks the removal



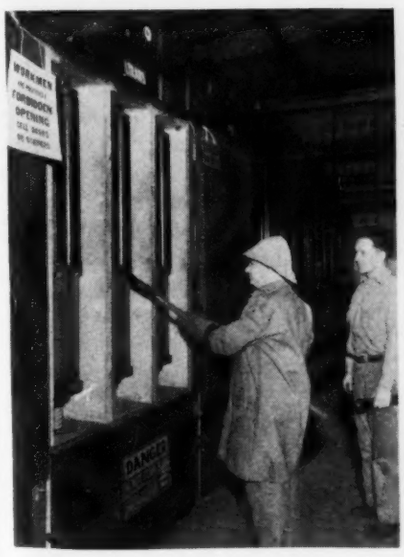
FORMS, NOTICES and memorandum blanks used in authorizing withdrawal of equipment from service, tagging switches, carrying on work and restoring apparatus to duty

Permit initiated by construction inspector notifies all interested parties, assigning time for work to be done. Removal of apparatus from service and red tagging of oil switch controls is done by operator on dispatcher's order, accompanied by written records and telephone check-back. Duplicate red tag on system diagram board is a further safeguard. Operator sends an assistant operator, with both written and verbal orders, to open proper disconnect switches after verifying the open position of the associated oil breakers. The opening of disconnect switches on bus sections is checked by the station supervisor to avoid improper operation of switches. Special ropes and barriers are then placed in front of the disconnects, with red tag for the construction inspector. These ropes and barriers cannot be removed except in the inspector's presence at the completion of his work. The inspector checks every knife blade himself before allowing work to proceed.

In the above illustration are shown the system dispatcher's permit with its notifications and approval, and below, the associated starting notice for the line (205-59) which is being relocated. At the upper right are the tagging memoranda of the dispatcher and operator; below this is the operator's memo to his assistant for the knife blade switching, and at the lower right is the master tag for oil switch control, the small tags being for the system diagram board.

PLACING special barriers in front of four-section auxiliary bus group feeder disconnecting switches being tagged out for maintenance

These are placed in the presence of the workman and are not allowed to be removed except in his presence, after completion of his work, insuring that these disconnects have been opened and will remain open until the workman personally views their reclosure. The illustration also shows safety clothing regularly worn by the operator during knife blade switching and shows the asbestos helmet, asbestos coat, rubber gloves and insulated switch hook, with additional high-voltage taping to prevent accidental bridging to ground. The maintenance foreman (left) holds a standard insulated flashlight. The view also shows the fire protection of the generator bus aisles, including thermostats, CO_2 gas piping and nozzles, and fog nozzles. Doors are ebony asbestos panels with fire-resistant wood frames, from which sap has been withdrawn and fireproofing impregnation substituted. Adjacent board sections are painted differently and small intervening barriers located to reduce the probability of switching errors. Pilot lights indicate the open position of the circuit breaker.



Cell doors were removed by the operator in accordance with posted warnings forbidding workmen to remove such doors. This view also illustrates a dual case of tagging for the construction inspector and the maintenance foreman, who are engaged on separate jobs. The construction inspector has the entire bus section tagged with a rope barrier in front of the sub-cell disconnecting switches with a red tag at each end of the rope. The maintenance foreman has one oil circuit breaker tagged, with special warning sign in front of the open sub-cell disconnects of that switch. This dual tagging is effective in preventing reclosure of knife blades before all workmen involved have finished, as the barriers and ropes are not removed until personally ordered off by the workmen. The view also shows special covering barriers over the adjoining switch cells, to prevent accidental contact with a live part in case a cell door should become displaced.

OPERATOR testing an oil circuit breaker to make certain it is dead before allowing workman to proceed

of all tools and devices used by workmen before the equipment is returned to service.

As an additional safeguard against system disturbance, each bus and piece of apparatus upon which work has been done is tested at full potential by a separate turbo-generator, or other means, at the completion of the day's work, to guarantee its fitness for regular operation.

Regular Instruction

Continuous instruction in safe operating practice is given to the operating and maintenance staffs by direct personal attention, by written memoranda and through monthly safety meetings. These last are held with free discussion for a half-hour period following the regular lunch time, and are addressed by supervisory men on such topics as proper tagging and switching methods, new equipment and operating schedules, and a review of lesser injuries which have occurred.

Periodic instruction is given to each man in the use of gas masks, prone-pressure resuscitation and fire fighting.

HANGING spare doors over adjoining cells when work is necessary on terminal disconnecting switches

A special platform is provided for insertion between cell partition walls, to allow the workman to be close to his job, thereby preventing the necessity of reaching in from a stepladder.

Utility Leads in Fluorescent Promotion

Detroit Edison by-passes the difficulties of fluorescent lighting by taking the lead with properly engineered installations — Customer confidence and customer satisfaction reward company's foresighted policy

L. E. TAYLER, Detroit Edison Company, Detroit, Mich.*

THE DETROIT PLAN ON FLUORESCENT—Six experts on fluorescent lighting, representing manufacturing and utility viewpoint, speak before Detroit Edison's fluorescent schools to electrical dealers, utility salespeople, contractors, jobbers, department store salesmen, drug store clerks and fixture manufacturers in nine-hour course

WHAT'S GOOD for our customers is good for us. If fluorescent is the lighting he should have, see that the application is correctly engineered. This means a satisfied customer and it means utility revenue. Capitalize on Better Light-Better Sight by selling up to adequate levels of illumination rather than down to gadgets that appear to be cheap. A program of this nature, judging from our experience with this new fluorescent lighting, means that difficulties with fluorescent disappear.

In most every line of business the trend is to develop better merchandise at lower cost. The automobile industry is an outstanding example of this trend. The oil companies do not complain bitterly because new cars are advertised and sold on the basis of "More miles per gallon." They realize that as over all efficiencies in the automotive field increase more cars will be sold, and hence their gallonage will increase. They further educated their operators to render a more complete and courteous service to the purchaser of their product, and there is no question but what the result has been a net gain.

Why is it, then, that more utility companies do not take the same attitude and do everything they can to further the use of fluorescent lighting and, through education, guide its use and application so that it will render a real service to their customers?

The Detroit Edison Company has established a definite policy of promoting the use of fluorescent lighting. We acknowledge the difficulties existing in the present methods of selling the equipment. This is particularly true in Detroit because of the demand for fluorescent lighting in industry.

There are some thirty manufacturers and assemblers of fluorescent equipment in the metropolitan area and an unknown number of salesmen who are selling their product without a sufficient knowledge of lighting principles. They sell purely on a price basis, with no thought as to improvement of illumination. They also advise against calling in the utility lighting engineer because they say utilities are not sympathetic with this new method of lighting, and of late they are spreading some weird stories about power factor. We also acknowledge the fact that in the majority of cases the lighting load is reduced. Yet the existence of all these apparent difficulties is no reason to obstruct the further use of this type

* In charge of lighting sales.

of lighting. If these lamps can give "more miles per gallon" it is up to us to promote their use.

There is a tremendous educational job to be done mainly because of the quick public acceptance of the lamp. The merchant wants it because it is a trademark of modernism. He considers it "streamline lighting" and believes that it is a mark of distinction. The industrial manager wants it because of high level lighting without the attendant difficulties of high radiation. Offices and schools also have their ideas regarding the advantages of using this lamp, and of course they all want it because they are told it is cheaper to operate. This kind of a market is naturally ripe for over-exaggerated sales tactics.

Informing the People

In an attempt to cope with this problem of education we organized a fluorescent lighting school designed to present fundamental knowledge of the lamp and its application to those in the merchandising and manufacturing fields in an attempt to present the advantages to themselves of doing a more intelligent job of fluorescent selling. The school operated one day each week for three weeks, starting at 1:30 in the afternoon and continuing until 10 p.m. A registration fee was charged which covered the cost of dinners and notebooks containing reprints of lectures. Total attendance was about 750 and the interest shown by those attending was very encouraging.

The school was conducted in the Detroit Edison Auditorium, but was sponsored by the Illuminating Engineering Society, the Electric Club of Detroit and the Michigan Electric Light Association. This spread the responsibility for the success of the school and also provided excellent mailing lists. These schools are very important because they bring home the fact that there is no substitute for knowledge, if a lasting success is to be enjoyed in getting a fair share of the buying dollar from this growing market.

Through the medium of advertising we are attempting to inform our customers of the necessity of getting the complete story about fluorescent lighting, particularly as regards costs. This has been in the form of both direct mail and newspaper insertions. The effectiveness of this effort is now being felt through the increasing number of inquiries from our customers who are contemplating installations and we are finding that they really appreciate our help in securing for them the most for their money.

Equipment Recommendations

The Detroit Edison Company has also established the policy of recommending only "Fluer-O-Lier" approved equipment, and it is felt that this should be the policy of all utility lighting departments. It provides the utility with a method of insuring to its customers equipment that is properly designed and constructed and yet obviates the necessity of tendency to advise against some local product that may be poorly designed, remembering that the manufacturer of the local product is still a customer of the utility. Again education along this line is necessary so that every local manufacturer can have the privilege of presenting his product for approval.

The first step in this direction was taken recently by inviting all the manufacturers, assemblers and jobbers to a meeting at which time complete details of the operation of the Electrical Testing Laboratories and the Fluer-O-Lier Association were presented. There were 111 reservations received for this meeting, which shows that these men appreciate the opportunity of learning how they may improve their position in this rapidly growing business. Every opportunity should be afforded those in the industry to learn everything possible about fluorescent lamps and lighting, because it is only through co-operation of this kind that these men will realize that the utility is sincere in its efforts to promote properly engineered installations, and it is also hoped that the manufacturers

[*Continued on page 142*]

SELLING UP FLUORESCENT—Refreshing, vigorous, positive selling marks Detroit Edison's fluorescent advertising this fall. Selling up, not down, the company accepts the customers' interests as its own, then collaborates in securing correctly engineered and therefore satisfactory installations

Condensate flow, booster pump noise, oil-pump sequence and dust emission controlled—Car dumper found justified and hoppers provided for slag

New Unit Provides Occasion for Station Refinements

C. E. MILLER, Potomac Electric Power Company, Washington, D. C.

ADDITION of a third unit (50,000-kw. turbo-alternator with 525,000-lb.-per-hour steam generator) to Buzzard Point station afforded the opportunity to introduce several innovations while preserving the low cost production and the high reliability (which has averaged better than 95 per cent). Its speed is 1,800 r.p.m., the pressure is still 650 lb., but the temperature is raised to 900 F.

Condensate flow to the first of four-stage contact extraction heaters is controlled. Booster pump noise has also been controlled. A desuperheater section has been added to the fifth stage heater. Turbine oil pumps have been given automatic sequence control. Auxiliary air motor has been provided for the rotor of the air preheaters. Precipitators have a third section for 95 per cent elimination. Justification was established for a car dumper. New coal-handling technique has been adopted. Hopper-shaped slag pits are provided under the boilers.

Prior to this year Buzzard Point consisted of two 35,000-kw., 650-lb., 825-deg. F. turbo-generator units and two boilers of sufficient size to develop the full capacity of the generators. (See ELECTRICAL WORLD, December 30, 1933.) It was found that some gain in economy of generation could be obtained (about 1.3 per cent) by increasing the throttle temperature to 900 deg. F. with negligible increase in investment over the 825 deg. F. plant. Although steam generation problems increase slightly as temperatures and pressures increase, it was believed to be a conservative step to make this increase in temperature. As little gain in economy could be effected by increasing the pressure to 900 lb., the former pressure base of 650 lb. was maintained. This resulted in certain advantages to the plant, such as interchangeability of boilers and turbines. The change in temperature between old and new units does not present any difficulties which would interfere with station flexibility. The new boiler is equipped with oversize controls of superheat temperature so it may be maintained at 850 deg. F. instead of 900 deg. F. if desired.

Four-Pole Unit

Although units are available, in the sizes considered, for operation at 3,600 r.p.m., an 1,800-r.p.m. machine was selected for the following reasons: The 3,600-r.p.m. machine shows some gain in economy, but this was offset partially by the higher fixed charges on the increased investment. Since operating experience was highly satisfactory with existing machines, it was thought unwise to change unless considerable advantage could be definitely assured by the higher speed. Space was not a factor, since the available turbine room dimensions accommodated the 50,000-kw., 1,800-r.p.m. machine without difficulty.

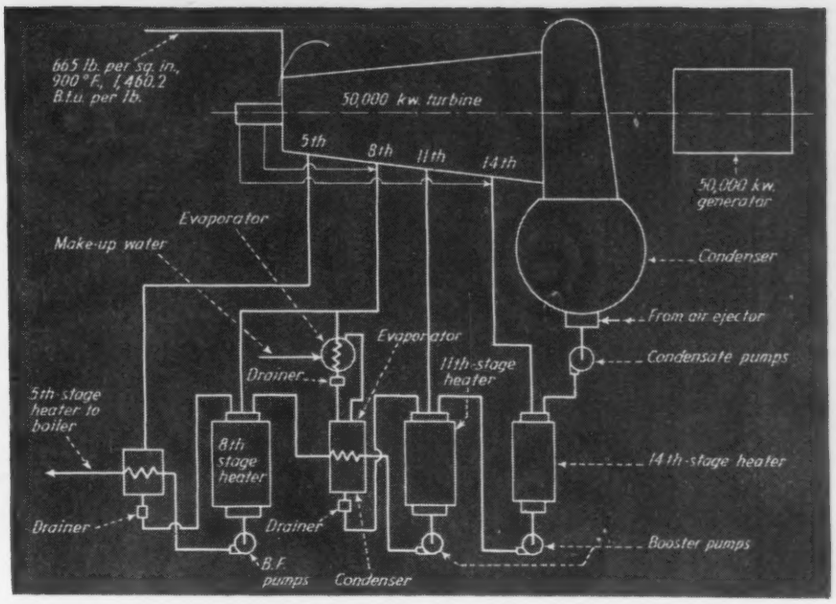
Hydrogen cooling on the generator was also available, but at 1,800 r.p.m. the economy of this method of cooling, in our opinion, did not justify its additional complication and cost.

Four stages of extraction are being utilized, as compared to the former three stages. An economic analysis of the four vs. three-stage extraction cycle justified the additional bleed point on a 50,000-kw. unit when it was not justified on the smaller machine. Direct contact heaters are used on the first three heaters as on existing units. Previous studies had been made and this cycle was found to be of maximum efficiency

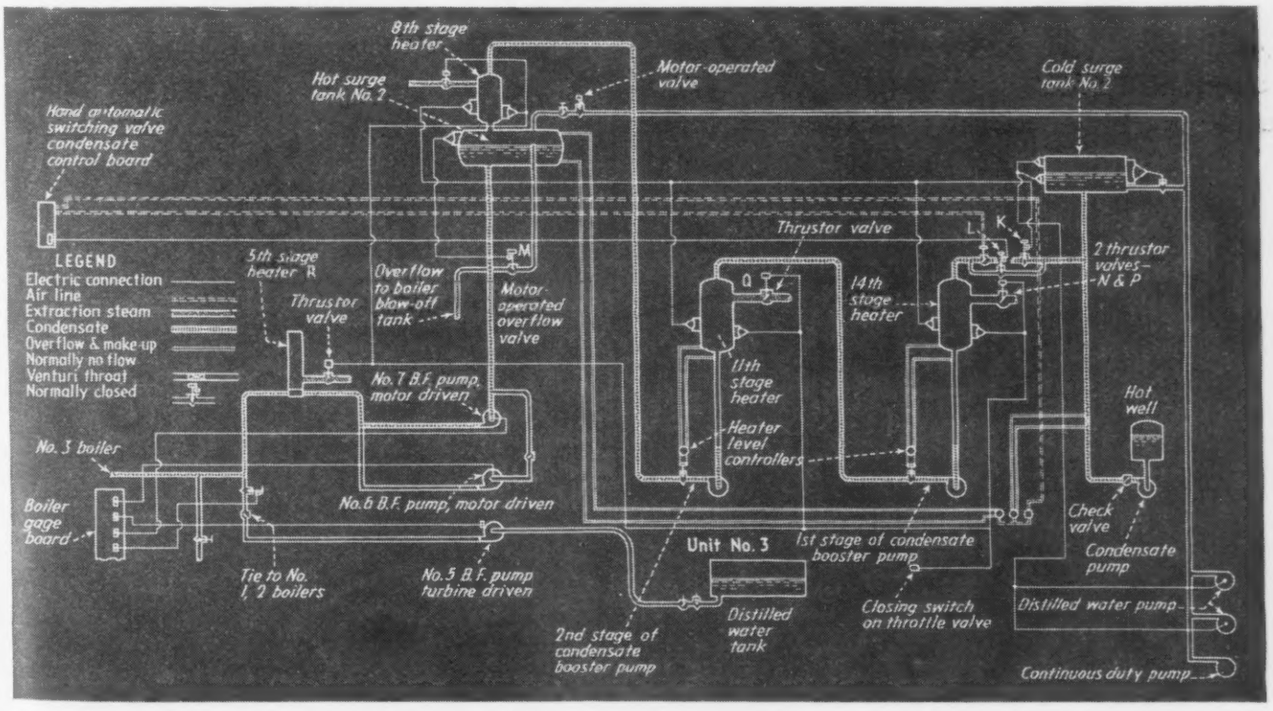
consistent with simplicity and low cost. Not only is the feedwater heated to the full saturation temperature of the bled steam, but also a greater quantity of steam is extracted from the turbine than would be possible with closed heaters, resulting in a lower B.t.u. rate per kilowatt-hour.

Use of contact heaters results in thorough deaeration of the condensate and eliminates troublesome small drip pumps or degradation of energy resulting from cascading of drips. There is no deterioration of maintenance problem as with closed heaters, since the internal construction consists merely of a series of trays. However, they present their own operating problems, which are not encountered with closed heaters, and it is important to recognize them.

The first consideration in the use of contact heaters is the importance of proper control of condensate flow. When the heaters are supplied with too much water, it apparently falls over the entire circumference of the top tray in the form of an umbrella instead of falling as rain. Steam entering from the turbine tends alternately to support and collapse this umbrella, with resultant pounding in the heater. In addition, the umbrella tends to stop circulation of any noncondensible gases to the upper part of the heater and through the vent, which is also a contributing factor to heater disturbance.



FOURTH POINT of extraction at fourteen stage



AUTOMATIC LEVEL CONTROL regulates condensate flow without surges

Actuated by level of water in hot surge tank and flow of water in condensate pump discharge line.

Two floats on each heater operate mercoid switches. The first closes the thrustor-operated, non-return valve in the turbine bleed line to safeguard the turbine against a back flow of water in case of a pump failure. The second closes a valve in the condensate supply line to the heaters themselves as a further safeguard.

The function of the thrustor-operated, non-return valves is to operate primarily as an ordinary check valve against any reverse flow of steam or water.

Thrustors have been provided to give a more positive action and thereby an increased factor of safety, which is a requirement with the use of contact heaters. The thrustor operates both on a closing of the main turbine throttle valve or a rise in water in the heater shell. The original installation provided for oil-operated pistons to give this positive action on the bleeder checks. Thrustors have been found much more satisfactory, having eliminated the nuisance of considerable oil piping. These controls are simpler since they are controlled directly from a float-operated mercoid switch on the heaters or from closure of a contact on the throttle valve.

To obtain satisfactory operation it is necessary that changes in rates of condensate flow be made slowly and, on the average, conform very accurately to boiler demand. This practice insures that there will be no sudden surges to flood the heaters and that there will always be sufficient water in the hot surge tank for boiler feeding. The supply of condensate to the first or fourteenth stage heater at Buzzard Point is regulated by an automatic level control, which takes its impulse from two sources—(1) the level of water in the hot surge tank and (2) the flow of water in the condensate pump discharge line. The level impulse and flow impulse are "totalized" in a special relay and the resultant pressure is used to operate the automatic valve.

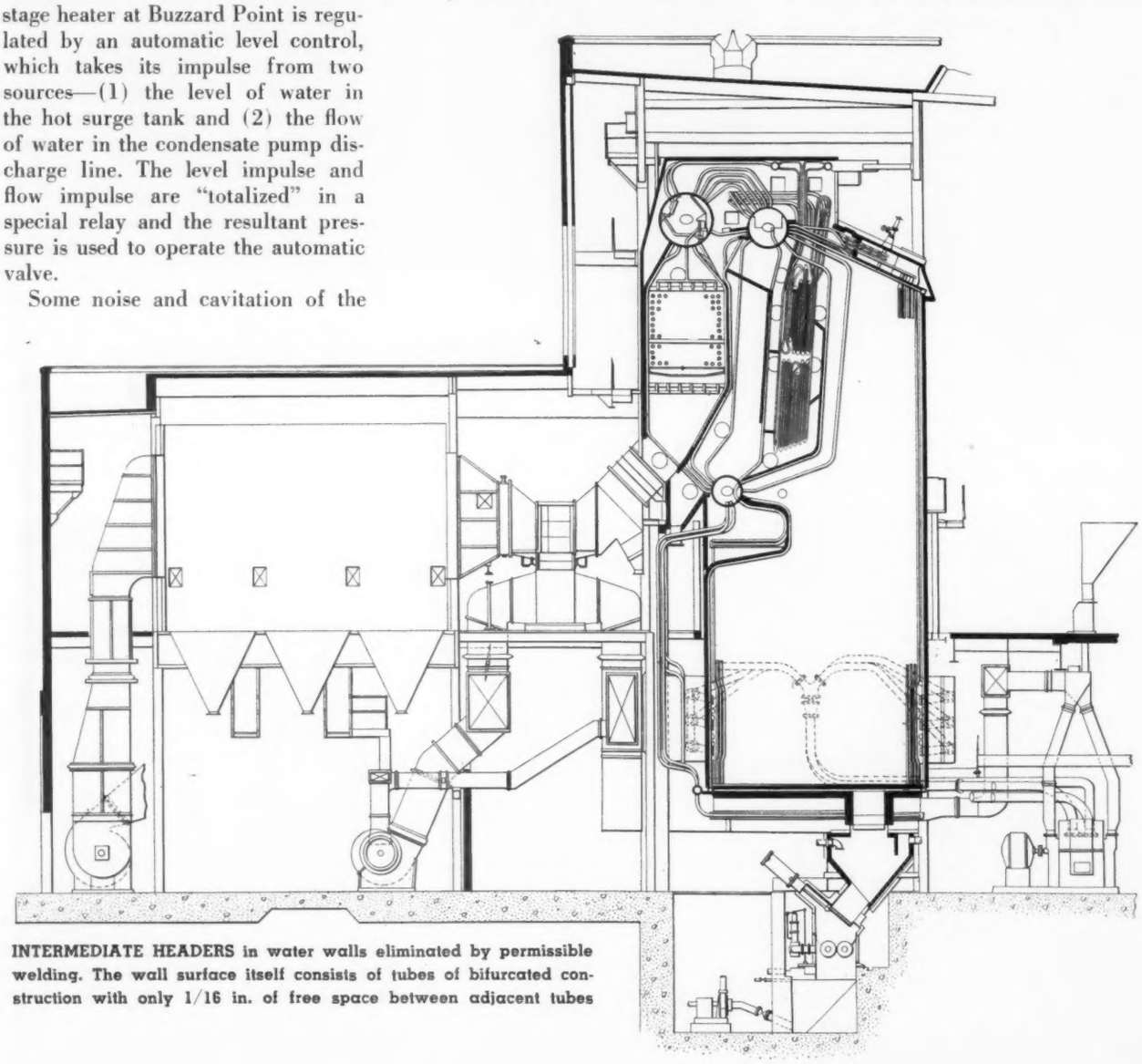
Some noise and cavitation of the impellers was experienced on the original condensate booster pumps. To prevent this trouble a method of controlling the suction head on the pumps was tried on No. 2 unit and was entirely successful. Experience has shown that any pump troubles are practically eliminated and reliability is greatly improved by such control.

The control operates from water level in the bottom storage section of the heater. A rising level in the heater opens a control valve in the discharge of the condensate booster pump, while a falling level closes the valve. This insures a head of water on the suction of the pumps equal to the static head of the elevation of the heaters. This device is particularly advantageous in running with light loads on the turbine when only a very small amount of hot water is being handled by the booster pump unit. The mixture of steam and water handled by the pumps under these conditions, without level control, has been found particularly noisy and injurious to the pump impellers.

Experience has demonstrated that the application of these automatic features has made the contact heater cycle practical and simple to operate. Coupled with the other advantages, it resulted in the choice of duplicate equipment in the 1940 addition.

It was found advantageous, in the case of the fifth stage closed heater, to incorporate a desuperheating section in the shell of the unit. By taking advantage of the superheat in the steam at this bleed point, with this shell construction, higher feedwater temperatures are obtained. In this case the temperature of the water leaving the heater is 3 deg. F. higher than the corresponding saturation temperature of the bleed steam.

The turbine is a seventeen-stage unit with a cast carbon molybdenum steel casing. The casing consists of a continuous upper and lower casting shell from and including the valve chest to the last row of blades. This method of construction has eliminated two joints that have been some source of maintenance, one at the

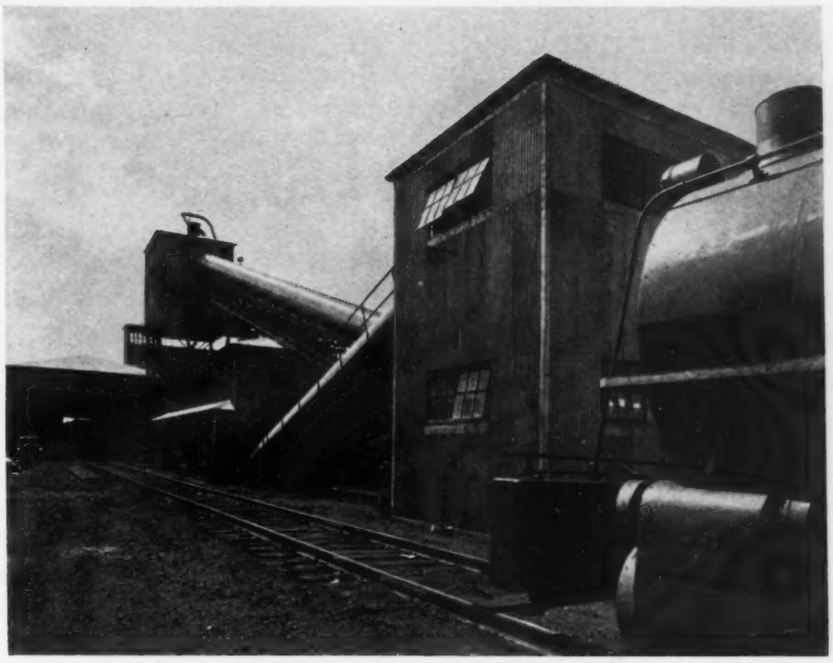


INTERMEDIATE HEADERS in water walls eliminated by permissible welding. The wall surface itself consists of tubes of bifurcated construction with only 1/16 in. of free space between adjacent tubes

valve chest, the other at the joint between high- and low-pressure casing.

The oiling system has been changed considerably. Due to past difficulties in maintaining regulation on turbine-driven auxiliaries, the present auxiliary oil pump is equipped with a constant-speed, alternating-current motor drive. A third pump for supplying oil to the bearings is provided to serve as an emergency source of oil in case of failure of both the main and auxiliary oil pumps and also to supply oil for operating the turbine when it is on the turning gear. This emergency or turning gear oil pump has both an a.c. drive for normal operation and a d.c. drive from the station storage battery in case of failure of all other sources of power.

The sequence for the operation of these various oil pumps is entirely automatic. A failure of the main oil pump will drop the governor oil pressure, close a contact and start the motor-driven auxiliary pump. This occurs before the governor bearing oil pressure is affected appreciably. If the bearing oil pressure drops further, due to failure of the auxiliary oil pump to start, the turning gear pump will cut in automatically on the a.c. drive. A failure of the a.c. source of power on this pump will automatically change it over to the direct-current motor drive supplied from the station storage battery. The turning gear pump will provide proper lubrication to bring the turbine unit to rest. This arrangement provides a safe, reliable means of turbine governing and lubrication.



CAR DUMPER and coal handling capable of 500 tons per hour, tracks to bunker. Rotary car dumper at left. Next, drag control tower, storage conveyor and weigh-house. A conveyor (under the street) connects this unloading equipment to station bunker conveyor

A single boiler rated at 525,000 lb. per hour supplies steam to the 50,000-kw. turbine. The boiler is of the three-drum, bent-tube type and fired tangentially from each of the four corners of the furnace. Certain advantages have been incorporated in the new design in an effort to reduce maintenance and outages to a minimum. The furnace itself is of sufficient size so that the temperature of the gas entering the first bank of boiler tubes will be around 1,900 deg. F., well below the sticky point of any coal that might be used for fuel. Particular attention has been paid to the elimination of potential sources of leaks. Intermediate headers in the water walls have been

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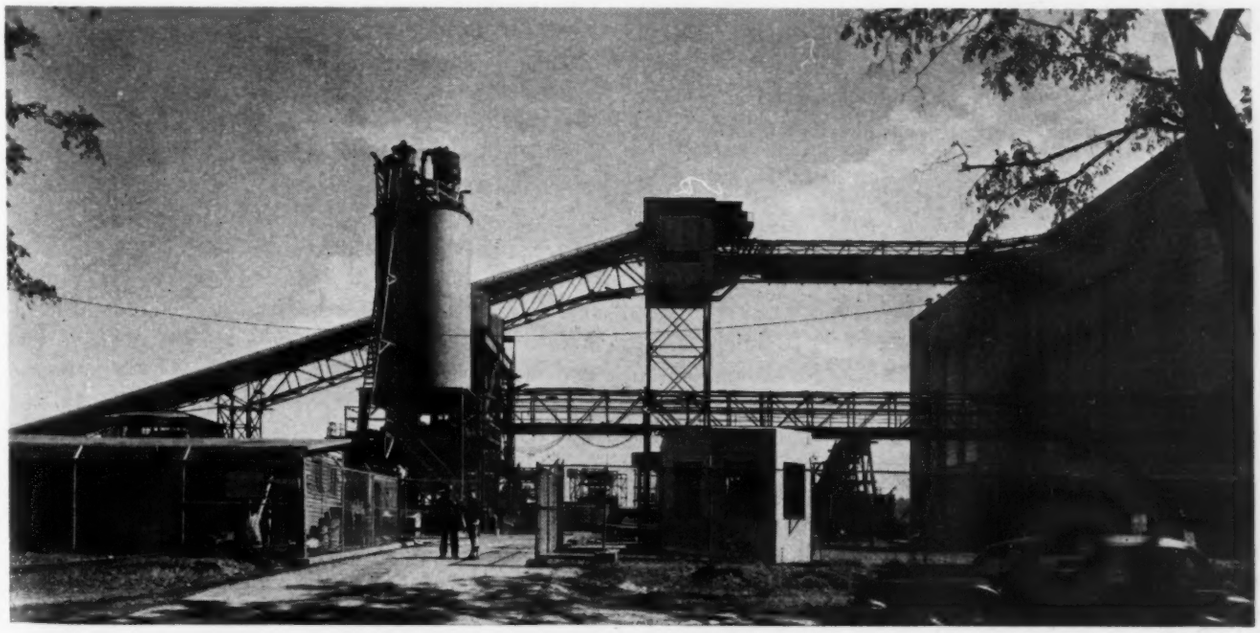

COAL AND ASH HANDLING at rear of station. Two 42-in. coal conveyors behind flyash and slag storage tanks

Editorials

S. B. WILLIAMS, *Editor*

Neighbors of the Storm

LATE LAST MONTH Amarillo, the largest city in the Texas Panhandle, was visited by a freak ice storm that wrecked its entire distribution system. Yet within five days service had been restored to the major portion of the customers of the area.

There is a thrilling story in this Amarillo episode that adds one more page to the history of service to the public by private utilities. Communities that have gone through flood or hurricane or any other devastation know this spirit—the spirit of "the show must go on."

Left to themselves, the linemen of the Southwestern Public Service Company could have restored service eventually. The men would have worked day and night without complaint, but it would have been weeks before the last customer had his lights again, and in the meanwhile a community of 52,000 would have led a crippled existence.

Instead, line trucks from fourteen companies, some as far away as 700 miles, rushed to the stricken city with trained crews, equipment and auxiliary generating equipment. Telephone service was in like difficulties, but the local telephone company is part of a nation-wide system on which it can call for help. Southwestern Public Service is part of a small scattered group, so its help had to be voluntary.

It was the neighborliness of these companies that, with their portable generating equipment, helped to restore drinking water to Amarillo—not some neighboring municipal water supply crew. This neighborliness is an inherent quality in private ownership.

Some one called these line crews the "soldiers of the storm." We like to think of them as neighbors of the storm—neighbors that came, some of them, 700 miles to help another restore its service.

This episode, however, has a much greater significance at the moment. It shows how well prepared are utility employees to handle emergencies, whether at home or elsewhere. Should war, with its bombing, come to our country, or should essential service to munitions production be damaged, there are trained men everywhere to restore service with the utmost speed.

This isn't just happenstance. Utilities that expect to serve their communities well must always be prepared for emergencies, and to do so means well-organized crews of trained men—men to whom service continuity has a meaning almost sacred.

There Will Be No Power Shortage

THE PRESIDENT has been advised by Chairman Olds of the Federal Power Commission that while the power capacity will be adequate for 1941, in 1942, when the full effect of defense requirements will be felt, there will be a power shortage of more than 1,500,000 kw. This statement accompanied the first monthly report of peaks, forecasted peaks, capacity and reserve.

This isn't the first time that the F.P.C. has predicted an impending power shortage, nor is there any reason to believe that this forecast will be any more reliable as to the future than previous ones. Our reports, published in this issue, from areas mentioned as likely to be in trouble give no indication that a shortage will occur either in 1942 or any future date.

The data in this first monthly report are not questioned. The interpretation and the manner in which they are being used, however, show how easy it is to set up statistics to prove a point.

The data in the monthly reports contrast maximum requirements up to the next twelve months with net assured capacity. The latter figure is given up through 1942 and the maximum requirements are extrapolated on the basis of data for the past four years.

In arriving at net assured capacity the commission, and rightly so, made no allowances over the worst condition. Therefore, the actual conditions in 1942 will probably be better.

The estimated shortage, however, gave to reserve no place in serving the peak. In other words, what the report actually shows is that in certain areas the utilities in 1941 and in 1942 will be borrowing on reserve to carry peak. The data, however, show no uniform ratio of reserve to net capacity.

Although it is obvious that this report will be used to strengthen the President's request for money for the St. Lawrence and some other federal power projects, notably in Georgia and Arkansas, one cannot help feeling that the Administration's own figures provide scant necessity for enlargement of the federal power program.

If shortages are going to develop by late 1942, there isn't a thing in the world that a new hydro project can do to help that situation. It is difficult to see how any additional water-power developments can have any defense significance unless the program is going to last much longer than any one now contemplates.

In the two years that remain before most of the 1942 peaks occur additional transmission and steam plant capacity can be built if any necessity arises.

In fact, this report, which obviously would make out the best case possible for the Administration, is so weak in positive unassailable power-shortage data that one begins to understand why the President is going to Congress with St. Lawrence. By sharing the same fate as Passamaquoddy and the Florida Ship Canal, the President will be relieved of the responsibility for taking an untenable position on further federal hydro development.

As we have said in the past, while some embarrassing situations may develop, there is no impending power shortage. The utilities up to this time have always been prepared. Why should one expect them to fall down now?

Tryout Emergency Equipment

POWER SYSTEMS have steadily been made more reliable, more immune to interruption. It's been accomplished in part by protective equipment and in part by transfer facilities that switch from distressed circuits to good ones. There is always, however, the residual risk of faults, and no matter how well the system is fortified there is a field of service for protective equipment to maintain circuits at good performance levels.

However, the more reliable the system the less often any piece of protective equipment or transfer device is called upon to function. Many of these devices stay in the open or closed position for weeks on end. They are often exposed to the elements and subject to seizing, "freezing" and the ice incrustation of exposed contacts. Modern devices are well-proofed against such impediments to positive and instantaneous functioning, but as much cannot always be said of those of an earlier vintage. Some do not have the torque, the bearings, the unlocking action, the self-cleaning attributes of present-day devices.

Since many of these devices may have been on the lines, inoperative for long periods, the rapidly growing loads taxing the circuits more and more increases the necessity for more attention to inspection and patrol operation of these mechanical sentinels to make sure they will function when called on. The present season would be a good one to accelerate the tests and inspections before winter interferes with accessibility and accentuates the possibility of trouble.

Personnel Preparedness

A RECENT STUDY of Boston Edison's personnel age and sex distribution shows that 11 per cent of those on the payroll are single men of draft age; 17 per cent are married men in this category; 55 per cent of the number of employees are males outside the 21-35-year registration limits, and the remaining 17 per cent of the nearly 3,400 employees are women. If these figures are any criterion, a broader study would show that stability of employment in the industry is reflected by the mature average age of utility employees in general. Such a study might be useful now, when the preparation of utilities for maximum operating efficiency is second only to the provision of power as a prime necessity of defense material production.

If Boston's figures are comparable to others, it is fair to infer that for the present, at least, utility operations can be carried on along with a large percentage of normal staff rosters. The situation is quite different from that in the machine tool, aircraft and shipbuilding industries, or in the navy yards and arsenals. There forced training of personnel to perform single operations in mass production is an acute problem to which attention is being successfully given, whereas it is probable that most utilities will be able to carry on, for the present at any event, without such highly intensive educational measures.

Despite all this, the time seems ripe to conserve utility personnel for any potential emergencies against which safeguards can be planned. This implies bringing up to date information as to the records, proficiencies, special talents, hobbies and aptitudes of personnel; job transfer possibilities; present and prospective methods of training for more efficient or modified work; the expediency of recalling retired employees for temporary service, and the possible substitution of women in certain operating jobs or routine activities to which feminine skill and patience are adapted.

Switching Capacitors

SOME OF THE HESITANCY in applying capacitors is undoubtedly attributable to the fear of high voltage at times of light load. One possible answer is to switch the capacitors off at such times and another answer is to think of capacitors and some form of voltage regulator as a team to work together for best results at all values of load. As that idea takes hold there will probably be less call for switching the capacitors off, either manually or automatically. Meanwhile devices have been provided to perform this function when the voltage goes up or the line current goes down, adverse in phase relation or magnitude.

There is another practicable reason for switching capacitors on and off, and that is to control losses in the direction of better over-all system efficiency. Reactive component is much more constant than the power component of load on a circuit, and that inherently gives the capacitors a better opportunity to do their good work, both in voltage regulation and in loss reduction. This is less true of some of the industrial feeders, and this field may offer really the best opportunity for beneficial application of automatic capacitor switching.

Periodic operation of large inductive equipment is thus a prime index of a chance for capacitor switching to earn its added cost in terms of losses averted. But minimizing losses at one point gives no guarantee of the same result farther back to the station; each instance warrants a careful analysis to make sure the benefits of the permanently installed capacitor are not obscured by unjustified switching.

St. Lawrence Inconsistencies

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

"WE must have ratification of a St. Lawrence Seaway Treaty promptly," Leland Olds remarked recently, "because even if we start work in the near future it will be 1945 before we begin getting the power."

It is curious how many times that superstitution about things happening in threes seems to have something to it. One wonders if the St. Lawrence Seaway is going to be the third of a strange trio of public-spending episodes.

The President started work at Passamaquoddy, Me., to "harness the tides," with relief funds for which Congress had given him a blank check. After millions had been spent and a frontier town development had grown up at Eastport the President passed the buck to Congress. Unless the law-making body would approve its continuance, he made it known, work at Passamaquoddy would be discontinued. Congress refused approval and the work was discontinued.

Strike Two !

Similarly the President, again with relief funds, started work on the Florida ship canal. Again, after spending millions, he passed the buck to Congress, and in this case also Congress refused to approve. So the work stopped there.

Back in 1934 the President asked the Senate to approve a treaty for the St. Lawrence Seaway. The Senate decisively defeated the treaty.

Every canvass of the Senate since has shown that the fundamental objections to the seaway on the part of individual senators representing the Atlantic Coast and Gulf States were such that it would never be possible to obtain the two-thirds majority necessary to approve a treaty.

Last winter there were hints that the White House would approach the problem from a different angle—ask appropriations for the preliminary work without proposing a treaty. This course would have required approval of both the House and Senate, but in each case by a majority only.

Opponents of the seaway were really alarmed about that. They were not at all sure they could muster a majority in either House or Senate against an appropriation.

But recently the President, again, as in the case of the Florida ship canal and Passamaquoddy, using funds voted in blanket form, has actually started expenditures on the St. Lawrence Seaway.

Now comes the question of whether the work will be continued, with blanket defense funds, or whether, as in the two other cases, he will eventually throw the whole thing back in Congress' lap.

One thing is certain, the interests of the Atlantic and Gulf ports, and the railroads serving them, are so strongly against the St. Lawrence Seaway that no matter what form the new St. Lawrence Seaway treaty may take, it cannot muster that two-thirds majority.

It is not a power question that is important in the Senate's opposition. It might be that if the seaway phase of the project were dropped the Senate would overwhelmingly approve a treaty looking to further power developments. It is rather curious that the President has not taken this tack, for there is nothing to indicate that he has ever really taken the seaway phase of the project seriously. On the other hand, he has always been enthusiastic about public ownership of electric developments, and particularly of hydro-electric projects.

As every one knows the Administration has been trying ever since the war in Europe broke out to build up the idea in the public mind that there was a serious threat of a power shortage in this country. All sorts of schemes, from the famous Northeastern grid system up and down, have been evolved with the notion of furthering the cause of public ownership of the electric industry under the cloak of national defense necessity.

On December 6 the Federal Power Commission made public the first of monthly reports on "Electric Power Requirements and Supply in the United States." It is a surprisingly temperate document in view of the known pressure behind it. The press release lists various sections of the country in which tremendous expansion of the defense industries are likely to cause power shortages. First on the list is upper New York State.

If This, Not That

Study, not of the press release but of the charts themselves, reveals an interesting fact. This is that while up-state New York is No. 1 bad spot, New York City is very strong in reserve capacity! In view of the Administration's eagerness to have the entire Northeast, from New England to the Mississippi, hooked up in a grid system, so that strong spots could supplement weak, it could scarcely make the point that the distance from New York City to the weak spots up-state is too great to make any allowance for the city taking care of any peaks in the up-state defense load!

Nor is any consideration whatever given to the fact that there is much talk about priorities in other government agencies interested in defense, and it would be a comparatively simple matter to soften the peaks by a few simple restrictions on unnecessary uses of power at certain hours!

But what has all this to do with the St. Lawrence Seaway?

On the day before publication of this monthly report was permitted the *New York Times* (December 6) called attention to more practical possibilities so far as national defense is concerned.

"If the President wants more power now," said the *Times*, "he can have it merely by carrying out plans of the Special International Niagara Board, which call for the use of 600,-

[*Continued on page 120*]

NEWS OF THE WEEK

Utilities See No Shortage of Power in Emergency

Forecasts of alleged possible shortage by Federal Power Commission in report to President Roosevelt viewed as unfounded by industry — Cite new capacity and interconnections

Forecasts of a possible power shortage in the United States during 1942 as given in a report to President Roosevelt last week by Leland Olds, chairman of the Federal Power Commission, were considered unfounded by utilities from those areas where it is alleged the greatest need is likely to develop.

In the report, compiled by the commission's National Defense Power staff, which covers a six-year period—four years of past tendencies and two years of forecasts—Mr. Olds said that the demands for electric power, including those required for the national defense loads, can be met during the year 1941 in most cases by the existing facilities, although "hot-spots" and "bottlenecks" in certain local areas are likely to develop.

Lists Critical Areas

In most areas, Mr. Olds said in his letter to Mr. Roosevelt, the full effect of the national defense loads will probably not be felt until the year 1942, when the aggregate deficiencies in available generating capacity in certain areas will probably exceed 1,500,000 kw.

The areas where the greatest need is likely to develop, according to Mr. Olds, include upper New York State, Philadelphia region, including eastern Pennsylvania and New Jersey; Pittsburgh region, including western Pennsylvania; Chicago and northern Illinois and northern Indiana districts; St. Paul and eastern Minnesota; Southeastern States, including the Tennessee Valley area, North and South Carolina, Alabama and Georgia; Arkansas, northern Louisiana and western Mississippi; Idaho and Utah, and San Francisco and the northern California and southern Oregon region.

Transmission Limitations

In certain other areas, Mr. Olds declared, while it appears that the generating capacity installed and on order may be sufficient to meet the expected loads, the situation may be critical due to limitations of existing local transmission and generating facilities. These were given as New England, Ohio, Indiana and West Virginia, Norfolk and the eastern Virginia region and Florida, central and northern Texas.

Mr. Olds said that several of the areas where the greatest need for power is likely to develop and in which additional capacity will be required are closely associated with important river basin projects. These were listed as the St. Lawrence, TVA, Santee and Savannah rivers developments, and the Arkansas, northern Louisiana and western Mississippi area, which will eventually be benefited by developments in the White River Basin, Mr. Olds declared.

The report of Mr. Olds is the first of a series of monthly reports showing in graphical form the relation between power loads and the capacity available to supply them in the several areas into which the country has been divided for this continuing survey of power needs for national defense.

Northern California power men feel developments since the study of Mr. Olds have materially changed the picture there. Pacific Gas & Electric has announced the Dutch Flats hydro project and has amended application pending before the FPC license for 148,000 kw. on the two Feather River plants.

See No Shortage

From C. J. Strike, president and general manager of Idaho Power Co., and G. M. Gadsby, president and general manager of Utah Power & Light Co., come the statement that "completion early in 1941 of an interconnecting power line between Grace, Idaho, and Anaconda, Mont., will eliminate probability of a power shortage in Utah and Idaho."

The two utility executives stated that, anticipating increased demand for power in both states, affiliated companies in Montana, Idaho and Utah already are at work on the new high-tension line which will make available to these areas the present large Montana Power Co. surplus.

It was said that Montana Power lines already are interconnected with Washington and Oregon power pools and there will be available for several years a large surplus of power.

C. S. Lynch, executive vice-president of Arkansas Power & Light Co., stated that "there never has been a power

Pennsylvania Utility to Spend $5,000,000

A $5,000,000 expansion program for Pennsylvania Power & Light Co.'s "mine-mouth" steam-electric generating station located at Hauto, near Mauch Chunk, is to be undertaken, according to J. S. Wise, Jr., president. Mr. Wise said that an order had been placed with Westinghouse Electric & Manufacturing Co. for a 35,000-kw. high-pressure topping turbine. The new addition will increase the plant's capacity to 110,000 kw. It will go into operation in the fall of 1942.

shortage" in the area served by his group, and "there never will be." Mr. Lynch said that the company has "abundant capacity available to serve requirements for all foreseeable demands in the area which it serves."

It was declared by Mr. Lynch that in the event of an emergency Arkansas Power & Light could take care of 40 to 50 per cent more load than is now being carried. The company is interconnected with Mississippi Power & Light and Louisiana Power & Light systems.

North American Co. system reports that there is an abundance of generating capacity in the system and that since its original 1940-41 budget estimates of new capacity to be added were made earlier this year the 270,000 kw. to be added has been increased to 540,000 kw., including the new 80,000-kw. unit at the Venice station, where two 40,000-kw. units are to be installed. Further additions are being made at Potomac Electric Power Co., Washington, D. C., and the operating companies in Cleveland, Milwaukee and St. Louis areas.

To Add 360,000 Kw.

Officials of Commonwealth Edison Co., Chicago, said that there will be no shortage by 1942 in the Chicago and northern Illinois areas as indicated by the Olds report. It was said that the company has kept a close watch on additional power demands and requirements arising out of the defense program. The company is in the midst of a $100,000,000 expansion program for 1940-42, the objective of which is to maintain a minimum reserve capacity of 20 per cent. This program contemplates the addition of 360,000 kw. of capacity.

Samuel Ferguson, president of Hartford Electric Light Co., says that the report of the FPC relative to power facilities is correct as to New England in so far as it states that there is anticipated no shortage of generating capacity in 1942. "The inclusion of New England in the class of territories wherein may occur local shortages due to inadequacy of transmission facilities is unduly pessimistic as the various New England utilities are fully aware of all places where this might occur with present existing facilities and amply corrective measures are in progress to eliminate any possible danger from this source long before the maximum loads of 1942 will occur."

Frank D. Comerford, president of Boston Edison Co. and chairman of New England Power Association, said that by the spring of 1942 the two systems will have 163,000 kw. more capacity than on January 1, 1939. These two systems are interconnected at four major points and if necessary can be operated as a unit.

F. L. Hunt, vice-president of Western Massachusetts Companies, states that "the several power systems of New England have developed a network of high-capacity transmission lines designed to pool the steam and hydro resources of the region. Further expansion of such lines is now going forward and will soon be completed."

A survey of Connecticut power resources under the auspices of the state Department of Public Utilities indicated a liberal margin of reserve capacity in 1942 over defense industry and other requirements.

Henry B. Bryans, executive vice-president of Philadelphia Electric Co., said that the area, third largest area in the country, is amply equipped with electric power resources to meet all requirements of the national defense program. Mr. Bryans said that the company has effective installed generating capacity of 1,092,415 kw., without considering the capacity available through interconnections with other companies, to meet power loads. Mr. Bryans said that no shortage of power will occur in the area and that sufficient capacity will be available at all time to meet emergency or other power demands.

Will Meet Demands

Niagara Hudson Power System officials state that steps are being taken which are deemed necessary to meet any projected emergency power demands. They declared that this is evidenced by the fact that a new 80,000-kw. unit was recently placed in operation at the new Oswego plant and that another 80,000-kw. unit will go into operation next summer. Work is under way for an 80,000-kw. unit at Buffalo to meet projected power demands in that area.

A survey of the Commonwealth & Southern System shows that so far this year a 35,000-kw. unit has been put in service at the new Weadock plant of Consumers Power Co. and a 35,000-kw. unit at the Toronto station of Ohio Edison. During 1941 a total of 260,000 kw. will be added to the system. This includes 100,000 kw. for Georgia Power, 60,000 kw. in Atlanta and 35,000 kw. in Macon; 40,000 kw. at Mobile station of Alabama Power; 35,000 kw. at East Peoria of Central Illinois Light; 35,000 kw. addition at Weadock and 50,000 kw. at Morrow, both Consumer Power Co. plants. A substantial amount of new generating capacity is planned for installation in 1942. The system sees no power shortage in the area served.

Philip Sporn, vice-president of American Gas & Electric Co., said that the company's central system is one of the most completely interconnected and co-ordinated systems in the country, and there are on it no limitations or "bottlenecks" that prevent necessary transfers of power from one portion of the system to any other. "In spite of the fact that the area of the central system is particularly well located with regard to defense industry and large growths of load have taken place over the last two years," Mr. Sporn declared, "every demand for additional service is being met." The very extensive program for the extension of generation and transmission facilities now in progress assures that all future power demands will be met, he said.

To Add 340,000 kw.

It was pointed out by Mr. Sporn that over the next two years there will be added a total of 340,000 kw. of generating capacity on the central system. This includes 55,000 kw. at Twin Branch, Indiana, in April, 1941; 30,000 kw. at Windsor, W. Va., September 15, 1941; 85,000 kw. at Philo, Ohio, on November 15, 1941; another 85,000 kw. at Philo in 1942 and 85,000 kw. at Cabin Creek, W. Va., in 1942.

Mr. Sporn pointed out that the transmission system is being extended and new interconnections are being made wherever it has been possible to work them out to improve the power supply situation. About a month ago, he said, the 132-kv. interconnection from Muncie, Ind., to the New Castle substation of Public Service Co. of Indiana was placed in service. The 132,000-volt connection between Muncie, Ind., and the Trenton substation of Cincinnati Gas & Electric will be placed in service next January. Work is under way on an additional 132,000-volt line from Philo to Canton, Ohio, and one will be built from Crooksville, Ohio (near Philo), to Lancaster, Ohio.

The Edison Electric Institute stated that "contrary to the conclusions of the FPC, our statistical data indicate that there will be ample capacity to meet the power demand in 1942 except perhaps in some isolated situations.

Major H. S. Bennion, vice-president and managing director of E.E.I., stated that "a preliminary report to the National Power Policy Committee a little over a year ago found that the shortage of capacity in thirteen industrial areas in 1941 under war demand conditions would amount to 3,260,000 kw. A revised report in January, 1940, found that the shortage in these areas in 1941 would be 1,300,000 kw. Now, with the national defense program under way, the Federal Power Commission finds that there will be sufficient capacity to meet the 1941 load. The same outcome may be expected of the 1942 shortage estimate."

Roosevelt to Push Plan for St. Lawrence Project

Will ask Congress to approve treaty with Canada providing for seaway and power development — Cites need for national defense and peacetime benefits — Anticipates opposition

In the name of national defense President Roosevelt will ask Congress, convening in January, to approve a treaty with Canada providing for construction of the St. Lawrence seaway and power project.

The announcement, presaging another battle in Congress over the long-debated project, defeated in 1934, was made by Assistant Secretary of State A. A. Berle, Jr., in an address before the Great Lake Seaway and Power Conference in Detroit last week.

Cites Importance

The message of Mr. Roosevelt, read by Mr. Berle, described the project as "comparable in economic" value to the Panama Canal. He said it would produce needed power for the production of aluminum in national defense.

Mr. Roosevelt said that the opposition which defeated the treaty in 1934 was "a mistaken opposition, based on failure to appraise the full needs of their country in the world situation which was even then developing." He asserted that he said then that "an opportunity is presented to complete a seaway comparable in economic value to the Panama Canal, a seaway with which the public development of St. Lawrence power is inseparably linked.

"It was then an opportunity. It is now a vital necessity."

Emphasizing the need of the project for national defense, Mr. Roosevelt pictured the St. Lawrence as offering a sheltered place, "a great landlocked sea, as a secure haven in which the United States will always be able to build ships and more ships in order to protect our trade and our shores."

Anticipating opposition to his proposal, Mr. Roosevelt said that "selfish interests will tell you that I am cloaking this great project in national defense in order to gain an objective which has always been dear to me."

Along with its benefits to national defense, he asserted that the project will contribute to the peacetime welfare of a multitude of laborers, small business men, home owners, farmers.

Mr. Roosevelt said that he is conducting conversations with Canada to work out the international aspects of the development.

From Canada came reports that negotiations for an American-Canadian treaty are continuing satisfactorily. The Canadian Parliament is expected soon to receive a statement from Prime Minister W. L. Mackenzie King on the progress of the negotiations. Parliament reassembles in February. A treaty, signed in 1932, was never presented to Parliament for approval because of its defeat by the United States Senate.

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Utility Gives Co-ops Lower Wholesale Rates

Lower wholesale rates for the North Arkansas and Carroll County rural electric co-operatives in Arkansas will become effective May 1, 1941, according to an agreement reached recently between officals of Arkansas Power & Light Co. and the Arkansas Utilities Commission. The effective date will coincide with completion of the Arkansas Power & Light Co.'s transmission line from Batesville to Cotter.

The new rates will equal those now charged to the other nine rural co-operatives in Arkansas served by the Arkansas Power & Light Co. The higher rates to the North Arkansas and Carroll County associations were explained by the necessity of purchasing the energy from the Southwestern Gas & Electric Co. When the new transmission line is completed the company can serve them from its own system.

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Norris Discusses Canadian Budget

Reflecting the high rate of industrial activity in the Montreal area, electricity output of Montreal Light Heat & Power Consolidated in November (exclusive of secondary power sales) again showed an improvement over last year, totaling 125,899,900 kw.-hr., an increase of 9.03 per cent over November, 1939.

John S. Norris, president, revealed that although total power consumption in the Montreal area last month was higher, use of electricity in the district during the period of the day of peak demand actually showed a slight decline from November of last year as a result of the government order continuing daylight saving time to assure adequate power reserves at all times.

In commenting on the new Canadian budget provisions, Mr. Norris said: "The embargo on imports and special excise tax on electrical appliances may affect sales of such products somewhat and have a corresponding effect on household consumption of electricity.

APPRECIATION BANQUET—Amarillo citizens showed their appreciation for the splendid work of utility men who restored service to the Texas Panhandle city when the ice storm felled service lines by being host to more than 700 at a dinner. It was a tribute, sponsored by the Chamber of Commerce, to the "storm soldiers" who rebuilt communication and power systems

But I think patriotic Canadians are agreed that our primary concern right now is to win the war. With this in mind, Canadians generally recognize that temporary restrictions during the emergency, and even sacrifices which will help in the war effort, are to be accepted cheerfully."

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Union Electric to Install Third Unit at Venice

Union Electric Co. of Illinois has announced it will spend an additional $7,500,000 to double the size of a new power plant under construction at Venice, Ill.

Two 40,000-kw. turbo-generator units, costing $11,500,000, including transmission facilities, now are being rushed to completion at the plant and will be in operation next fall.

The decision to erect a third unit, an 80,000-kw. installation, was reached because of prospective increases in power consumption due to the national defense program, coupled with an upswing in industrial activity resulting in a record output of electric energy in November.

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$600,000 Program

Dallas Power & Light Co. has started work on an improvement program to cost more than $600,000. New substations and a 60,000-volt transmission line are to be constructed. Ultimately the line will form a ring around Dallas.

NEWS BRIEFS

LAST WEEK WORK on TVA's Kentucky dam was again going forward after a strike of almost a week by skilled workers. Two thousand employees were made idle by the walkout.

APPROXIMATELY $642,000 will be added to the cost of Grand Coulee as a result of a recent land slide. Removal of the downstream slide and relocation of the railroad and highway are not getting under way. Grand Coulee says the payroll is going down, but the average hourly wage is going up. Labor rates are now $1.15.

FEDERAL POWER COMMISSION got an emphatic NO when it attempted to force its uniform system of accounts on Puget Sound Power & Light and get original cost data. The Pacific Northwest utility told a commissioner examiner that the FPC had no legal authority since the company operated intrastate.

EDISON ELECTRIC INSTITUTE members will "shuffle off" to Buffalo next June 2–5 for the annual convention.

MEXICO CITY, the Federal District and four surrounding states have gone on "electricity saving time" as clocks were moved ahead one hour from central standard time. Because subnormal rainfall meant only limited water for power generation, the area below the border must conserve 650,000 kw.-hr. Mexico City Light & Power serves the area.

IN BOSTON, where Dr. Alexander Graham Bell gave the world his successful invention of the telephone 64 years ago, his great-grandson, Alexander Graham Bell Grosvenor, received from Postmaster Peter F. Tague the

first sheet of the 10-cent commemorative postage stamp on the first day of issue. The presentation was made under the auspices of the Bell Stamp Club of New England, a group of collectors identified with the New England Telephone & Telegraph Co.

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Utah Power & Light Asks Interconnecting Line

Utah Power & Light Co., Salt Lake City, has filed with the Federal Power Commission an application for license for a high-power transmission line in Bannock and Bingham counties, Idaho, affecting public lands and lands of the United States within the Fort Hall Indian Reservation. This line will form part of the applicant's transmission system which will interconnect with the transmission systems of the Idaho Power Co. and the Montana Power Co.

The other two sections of the line will be constructed and operated by Idaho Power Co. and Montana Power Co. This application covers a line 57.3 miles long occupying a right-of-way 100 ft. wide for a distance of 0.166 mile on public lands and 26.231 miles on tribal and allotted lands within the Fort Hall Indian Reservation.

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Close West Memphis Deal

Mayor W. H. Hundhausen has signed a contract to buy electric and water facilities from the West Memphis Power & Water Co. for $210,000. The Mayor said means of financing the transfer have been discussed by the City Council, but details have not been settled.

HOTPOINT NEW LINE—Officials of Edison General Electric Appliance Co. talking over feature points of the new 1941 line of electric ranges at the showing of the entire Hotpoint line to distributors and utility men in New York this week. L. to r.—A. H. Jaeger, G. H. Smith, Ward R. Schafer, W. A. Grove, Chairman George A. Hughes and Vice-President R. W. Turnbull

REA Overhauls Setup In Policies, Operation

Shifts and reallocation of divisions and functions made among agency's top executive staff — Agriculture Department to assume broader and more direct authority

Climaxing several weeks of rigorous internal study, the Rural Electrification Administration has been drastically overhauled from stem to stern. The reorganization of the administrative set-up is considered by many to be the prelude to perhaps even more far-reaching shake-ups in policies and operations—whether to the right or left is still uncertain, but it may be significant that REA Administrator Slattery looks with favor upon the recently introduced Minton bill to extend the repayment period for loans from 25 to 40 years, an obvious step toward outright federal subsidies. This measure will be reintroduced and pushed in the next session.

Shifts Functions

The administrative overhauling was largely a shifting and reallocation of divisions and functions among REA's present top executive staff; it did not go so far as to result in ousters. New blood was injected, however, in the persons of Francis J. Sette, former Public Works Administration engineer, who was named to a newly created deputy administratorship, and John P. Evans, old-line Agriculture Department employee, who was named personnel head.

Both of these men were appointed several weeks ago, for the apparent purpose of preparing the ground for the shake-up. They took over much of the authority which had been concentrated in the office of Robert B. Craig, who was personnel chief in the Carmody administration of REA and later was elevated to deputy administrator, a title he now shares with Mr. Sette.

It is understood that both Mr. Sette and Mr. Evans were called in at the suggestion of Agriculture Secretary Wickard, the first move by that department to assume broader and more direct authority over the agency transferred to its jurisdiction in one of last year's Presidential reorganization shifts. Mr. Wickard also is reported to have assigned the Bureau of Agricultural Economics to study REA's policies and financial reports.

Four New Divisions

The reorganization, which comes on the heels of the Sette-Evans examination, abolishes the divisions of co-operative relations, engineering and operations and utilization. Four new divisions were set up, as follows:

Applications and loans, under C. O. Falkenwald, takes over the functions of acquisition, economic analysis, project examination and installation loans. The staff of co-operative relations was assigned to this division.

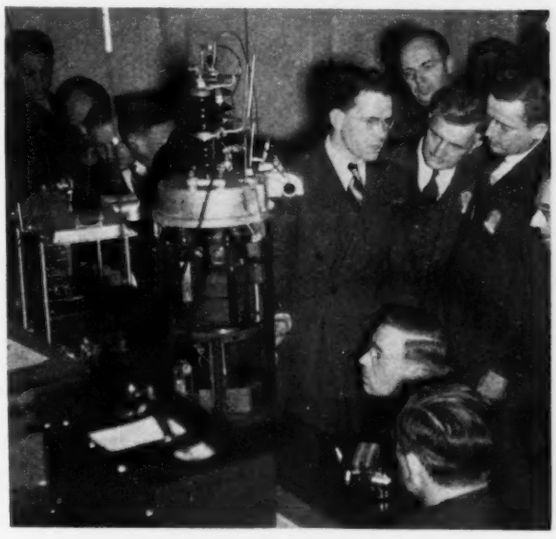
Technical standards, under M. M. Samuels, takes over distribution systems, power, consumers' service and special problems. Research engineering falls into this category.

Design and construction, under G. W. Thaxton, is made up of these sections: Construction costs analysis, generation and transmission, construction engineering, industrial power, buildings and structures. Also established under Mr. Thaxton is a new inspection section.

Co-operatives operations, under C. A. Winder, will direct the work of equipment service, rates, operations engineering, co-operative education, insurance, safety and taxes. Labor relations and farm tour units also are transferred here.

The finance division acquired a new unit, construction funds control under H. O. Hinson, to which was transferred the work and staff of budget control and budget units.

Junior engineers trainees were put under the direct jurisdiction of Mr. Evans, although the cost of this program is divided—two-fifths to design and construction, two-fifths to co-operatives' operation and one-fifth to technical standards.



REA—Group examining some of the new REA line equipment discussed by M. M. Samuels at the American Society of Agricultural Engineers meeting last week in Chicago. A series of new developments in line apparatus and service entrance equipment was introduced

New Unit on Line

Ohio Edison Co., subsidiary of Commonwealth & Southern Corp., has placed in operation a new 35,000-kw. generator at its Toronto plant, increasing the capacity to 175,000 kw. Plans are under way for another 35,000-kw. unit to go into operation in 1942.

New Low Cost REA Line and Equipment

Speaking in Chicago last week before the American Society of Agricultural Engineers on the subject of new ideas in rural electrification, M. M. Samuels, chief research engineer of REA and head of its brand new division of technical standardization, introduced a series of new developments in line apparatus and service-entrance equipment intended to improve reliability of rural line operation at a very low cost.

Among the equipment introduced was: (1) An automatic carrier current signal system that records on paper tape at headquarters not only the time and place of a branch feeder outage but gives a similar record of service restoration; (2) combination service unit consisting of cyclometer dial watt-hour meters and breaker type service entrance panel; (3) low-cost, direct-reading ground test meter, also fitting for connecting same in continuous down-lead ground wire; (4) 1-kva. distribution transformer of low core-loss type for rural lines, still in experimental stage; (5) portable radio noise locator, probably sell for less than $70; (6) three automatic reclosing circuit breakers; (7) milk cooler, one-can size—less than $100.

Mr. Samuels reported that while lack of adequate demand diversity data for farm application is making circuit

design difficult, enough data are at hand to indicate that 1½-kva. transformers are not the best size for rural loads. In many cases, he said, 1 kva. is ample.

Core losses are another problem, it was stated. According to Mr. Samuels well over 25 per cent of energy purchased by REA co-ops is used up in transformer core losses. In the last year co-ops paid to electric utilities $4,395,675 for power, of which $1,098,918 was for core losses, he declared. Because of this, and because REA lines have a relatively low annual fixed charge and a relatively high energy cost, it is economical for them to spend more in first cost to get low core loss in distribution transformers. A 1-kva. transformer is now being set up for production which, Mr. Samuels expects, will not sell for much over $25 and which has a core loss of 10 watts at 3.8 per cent regulation, compared to 21 watts for the 1½-kva. transformer with lowest core loss.

When REA found itself called upon to render service to establishments of importance to national defense many REA power sources were found not sufficiently adequate for this purpose, Mr. Samuels said. One of the remedies adopted was small mobile power plants on trailers, each a complete power house with two Diesel-generating units, switchgear and transformer. REA hopes to have enough of them throughout the country soon so that each REA project can be reached by one in a short time.

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Ickes Agrees to New Hetch Hetchy Plan

The generation-old dispute over distribution of Hetch Hetchy power in San Francisco appears to be nearing solution, but Secretary Ickes is outspokenly unhappy about it. Mr. Ickes agreed, after a conference with Mayor Rossi, that the latest revised plan E for municipal leasing of Pacific Gas & Electric Co. distribution facilities in San Francisco appeared to provide "formal compliance" with the Raker Act. But he bluntly said that if he had power to act upon the plan from the city's viewpoint he would never O.K. it.

Newest Hetch Hetchy plan provides, in brief, a ten-year leasing agreement between the city and utility whereby the company leases existing distribution facilities within the city, transmits Hetch Hetchy energy from Newark, provides additional energy needed and standby service, operates and maintains distribution facilities and makes additions and betterments subject to city direction. The city would perform all functions directed to sale of energy to ultimate consumers and would pay the company the cost of various services rendered, an agreed price for energy supplied, taxes and $4,900,000 annual rental for the distribution system.

Mr. Ickes left the door open to later disapproval if the formal contract terms do not meet his understanding of the outline. Then he listed a half-dozen objections to the effect of the plan on the city—all directed at keeping alive the movement for outright purchase of P. G.&E.'s distribution system or construction of competitive lines.

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Washington PUD Buys Facilities of Utility

The Cowlitz public utility district has taken over the electric facilities of Washington Gas & Electric Co. in Longview and Ryderwood, following the payment of $6,293,378. The sum was raised through a $6,000,000 bond issue.

The PUD was victorious in litigation extending over a three-year period.

James I. Metcalfe of Seattle, consultant power economist and former chief of the system planning and marketing division of Bonneville, has been employed by the PUD and will likely be manager of the system. Harry Kelsey, formerly with the Grays Harbor PUD, is assistant manager. The PUD has announced a $10,000 annual increase in the payroll of 50 employees. All former employees, with the exception of Robert Protheroe, manager, have been retained by the PUD.

MEETINGS

American Association for the Advancement of Science—Bellevue-Stratford Hotel, Philadelphia, Pa., December 27-January 2.

Housewares Manufacturers Association—National Housefurnishing Show, Palmer House, Chicago, Ill., January 5-11.

Missouri Valley Electric Association—Power sales conference, President Hotel, Kansas City, Mo., January 16-17.

Canadian Electrical Association—Annual winter conference of association committees, Montreal, Que., January 20-21. B. C. Fairchild, secretary, 804 Tramways Bldg., 159 Craig St., West, Montreal.

American Society of Heating and Ventilating Engineers—Annual meeting, Muehlebach Hotel, Kansas City, Mo., January 27-29. A. V. Hutchinson, secretary, 51 Madison Avenue, New York, N. Y.

American Institute of Electrical Engineers—Winter convention, Philadelphia, Pa., January 27-31. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

Edison Electric Institute—Electrical equipment committee, Statler Hotel, Detroit, Mich., February 10-12; transmission and distribution committee, Statler Hotel, Detroit, February 17-19. Major H. S. Bennion, managing director, 420 Lexington Avenue, New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual meeting, Institute headquarters, New York, February 17-20. A. H. Parsons, secretary, 29 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association—Winter meeting, Palmer House, Chicago, Ill., February 17-21. W. J. Donald, managing director, 155 East 44th Street, New York, N. Y.

Dismissal of Morgan as TVA Head Upheld

The dismissal by President Roosevelt of Dr. Arthur E. Morgan as chairman of the Tennessee Valley Authority has been upheld by the Sixth United States Circuit Court of Appeals.

In an opinion last week the court affirmed a lower court's dismissal of Dr. Morgan's suit, in which he sought the recovery of $4,583.33 alleged to be due him in salary. Judge C. C. Simons of Detroit cited a Supreme Court decision which said:

"The power to remove executive officers appointed by the President is conferred upon him by the Constitution and so may not be abrogated by statute."

The opinion said that "it requires little to demonstrate that the Tennessee Valley Authority exercises predominantly an executive or administrative function. The board does not sit in judgment upon private controversies or controversies between private citizens and the government, and there is no judicial review of its decisions, except as it may sue or be sued as may other corporations."

It was further stated that "it is not to be aligned with the Federal Trade Commission, the Interstate Commerce Commission or other administrative bodies mainly exercising clearly quasi-legislative or quasi-judicial functions—it is predominantly an administrative arm of the executive department."

On March 23, 1938, President Roosevelt removed Dr. Morgan from office for "contumacy." Previously he had been at odds with his fellow TVA directors.

Dr. Morgan filed suit against the TVA and board members David E. Lilienthal and Harcourt A. Morgan, who was appointed chairman, charging that his ouster was illegal and void and could be accomplished only by concurrent action of the Senate and House of Representatives.

District Judge George C. Taylor of Knoxville dismissed the action on August 25, 1939, because of its "failure to state a claim upon which relief can be granted."

•

G. E. Names New Manager for New York District

T. F. Barton, for the past two years assistant district manager of the New York district of the General Electric Co., has been appointed district manager, effective January 1. H. H. Barnes, Jr., for many years commercial vice-president of the New York district, will continue in that capacity.

Output at New High; 9.8% Above 1939

Continuing the upward trend, lately accelerated, that has been in progress since spring, operations of the electric light and power industry again broke all previous records in the week ended December 7 with an output of 2,838,270,000 kw.-hr., according to the Edison Electric Institute. The increase over the corresponding week last year was 9.8 per cent, closely approaching that of the preceding week and, with that exception, the largest since August 31.

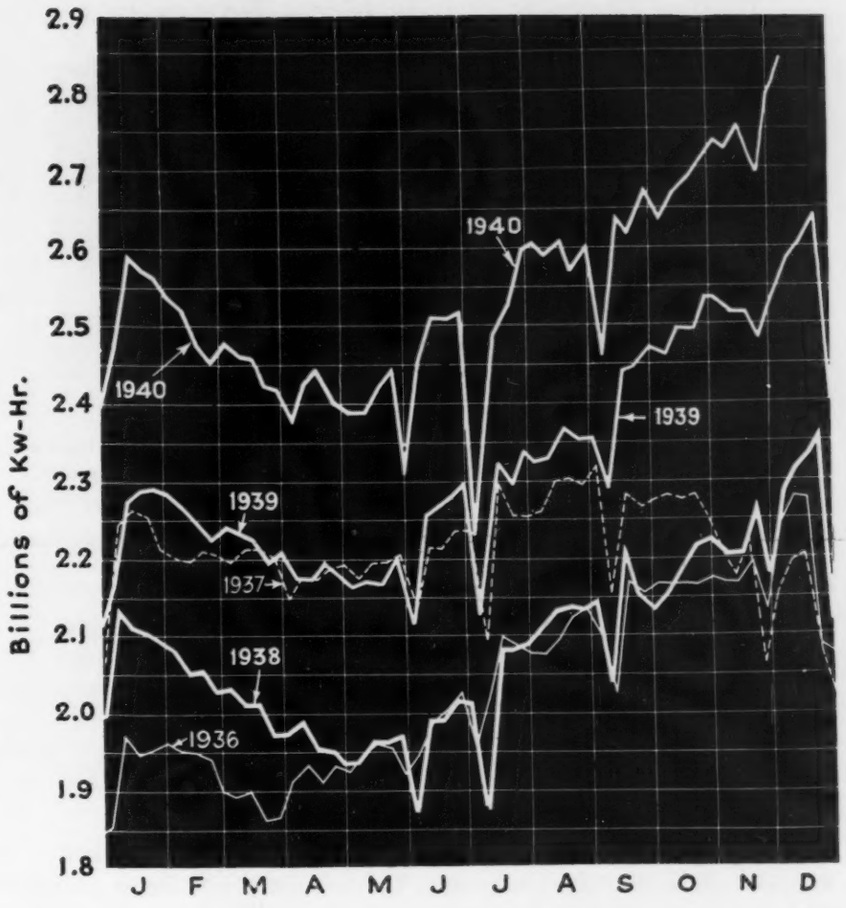
The gain over the preceding week was 1.5 per cent. The striking growth in recent years is apparent in the increase of 22.4 per cent over the like week of 1938 and 29.2 per cent over 1937. Further, the output has already overshot last winter's peak by 7.5 per cent, with the season's high point still to come.

Weekly Output, Millions Kw.Hr.

1940		1939		1937	
Dec. 7	2,838	Dec. 9	2,586	Dec. 11	2,196
Nov. 30	2,796	Dec. 2	2,539	Dec. 4	2,153
Nov. 23	2,695	Nov. 25	2,482	Nov. 27	2,065
Nov. 16	2,752	Nov. 18	2,514	Nov. 20	2,224
Nov. 9	2,720	Nov. 11	2,514	Nov. 13	2,177
Nov. 2	2,734	Nov. 4	2,537	Nov. 6	2,202
Oct. 26	2,711	Oct. 28	2,539	Oct. 30	2,255
Oct. 19	2,687	Oct. 21	2,494	Oct. 23	2,282
Oct. 12	2,665	Oct. 14	2,495	Oct. 16	2,276

Per cent Change from Previous Year

	Week Ending		
	Dec. 7	Nov. 30	Nov. 23
New England	+ 6.7	+ 7.5	+ 4.9
Middle Atlantic	+ 9.3	+ 7.5	+ 7.8
Central Industrial	+11.9	+12.6	+ 9.7
West Central	+ 6.3	+ 6.4	+ 6.2
Southern States	+10.5	+12.0	+ 9.0
Rocky Mountain	+ 3.6	+ 5.3	+ 3.8
Pacific	+ 7.0	+ 8.0	+ 7.1
United States	+ 9.8	+10.1	+ 8.6



Regional gains over 1939 were general, ranging from 3.6 per cent in the Rocky Mountain area to 11.9 per cent in the Central Industrial. In most regions they were a little under those of the week of November 30, the exception being the Middle Atlantic, where an increase from 7.5 to 9.3 per cent is indicated. In general, the Central and Southern regions have lately been showing larger gains over 1939 than other areas.

Energy Production Up 10% in October

Production of electric energy for public use continued to higher levels in October, totaling 12,813,530,000 kw.-hr., an increase of 9.8 per cent over the corresponding month of last year, according to the Federal Power Commission. Daily production during the month averaged 413,340,000 kw.-hr., or 5.4 per cent more than during September. For the twelve months ended October 31 production totaled 139,873,000,000 kw.-hr., a gain of 12 per cent over the previous year.

Of the total production during October, 29 per cent was produced by water power, as compared with 33 per cent in September and 27 per cent in October, 1939.

Reports received during the month indicated that the capacity of generating plants in service on October 31 totaled 41,285,664 kw., an increase of 153,664 kw. over that previously reported.

Total stock of coal on hand at electric utility power plants on November 1, 1940, was 12,506,516 tons, a decrease of 0.2 per cent from October 1 but an increase of 30.2 per cent over November 1, 1939. During October electric utility power plants consumed 5,046,659 net tons of coal, of which 4,812,235 tons were bituminous and 234,424 tons were anthracite, increases of 15.2 and 12.3 per cent, respectively, over September.

Co-op Must Collect Tax

The Arkansas Supreme Court has ruled that rural electric co-operatives in the state must collect the state 2 per cent retail sales tax from members. The decision reversed a Pulaski Chancery Court decision which has prohibited State Revenue Collector Z. M. McCarroll from collecting the sales tax from the Ozarks Rural Electric Co-operative Corp. Other rural co-operatives had been paying the sales tax regularly. The Ozark corporation had been collecting the tax until it entered the suit.

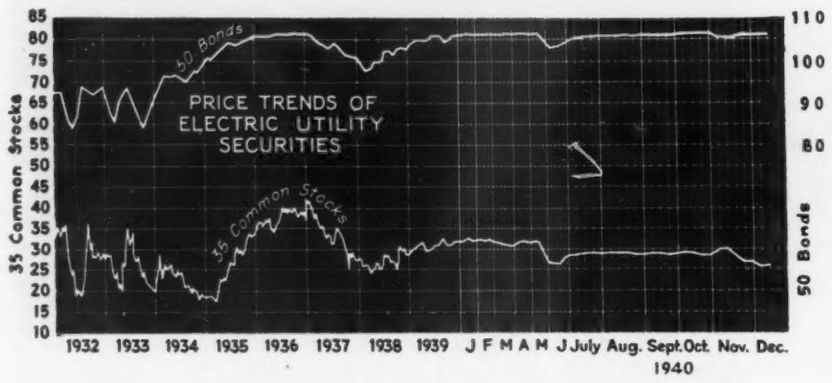
October Output Declines

October output of central electric stations in Canada totaled 2,487,455,000 kw.-hr., compared with 2,399,678,000 in September and 2,589,956,000 kw.-hr. in October, 1939. On the year ago comparison, this is the first decline registered in any month since December, 1938. Exports to the United States were 168,904,000 kw.-hr., against 186,983,000 kw.-hr. the previous month and 151,794,000 kw.-hr. a year ago.

FPC Grants Rehearing

Acting on a petition of the Nantahala Power & Light Co., the Federal Power Commission has granted a rehearing of its finding, adopted November 5, that the interests of interstate commerce would be substantially affected by construction and operation of the proposed Fontana hydro-electric project on the Little Tennessee River in Swain and Graham counties, North Carolina. The rehearing is to begin on January 15.

Utility Security Prices Move Downward


PRICE TRENDS OF
ELECTRIC UTILITY
SECURITIES
50 Bonds
35 Common Stocks
35 Common Stocks
50 Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1932 1933 1934 1935 1936 1937 1938 1939 J F M A M J July Aug. Sept. Oct. Nov. Dec.
1940

Electric light and power stocks dipped slightly during the past week, the "Electrical World" index reaching the 26.7 mark, compared with 26.8 last week; last year, 31.4. Bonds also turned downward, "Electrical World" index, 106.1; last week, 106.2

Orders Simplification Hearing Next Month

Securities and Exchange Commission has ordered corporate simplification proceedings against the Middle West Corp. and its subsidiaries, charging that the capitalization of these companies in the system do not conform with Section 11(B)(2) of the holding company act of 1935.

The subsidiaries listed in the order are Central & Southwest Utilities Co. and American Public Service Co. The hearing will be held on January 6.

The commission seeks to determine what steps, if any, are necessary by Middle West Corp., Central & Southwest Utilities and American Public Service Co. to insure that the corporate structures or continued existence of Central & Southwest and American Public Service "do not unduly or unnecessarily complicate the structure or unfairly or inequitably distribute voting power among the security holders of the holding company system of the Middle West Corp."

In addition, the commission seeks to determine what action, if any, is necessary by Central & South West Utilities Co. or American Public Service Co. to insure that voting power is not inequitably distributed among the respective security holders.

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Virginia Utility Will Proceed with New Plan

Virginia Corporation Commission has entered an order authorizing the Virginia Public Service Co. to proceed with a proposed $36,500,000 refinancing plan, but requiring a $3,500,000 cash contribution to its capital and reducing its board of directors to nine.

The order, coming after a three-day hearing, authorizes the private sale to four insurance companies and a bank of $28,000,000 of 3¾ per cent bonds and $8,500,000 of debentures. The commission's authorization modified the original proposal adopted in October by the Virginia Public Service board of directors by an eight-to-two vote.

•

Permit Refinancing Plan; Interest Rate Listed

Virginia Corporation Commission has approved the $100,000,000 refinancing plan proposed by the Appalachian Electric Power Co. The company filed with the SEC this week an amendment representing the underwriting syndicate and the interest and dividend rates on its proposed issues of $70,000,000 of first-mortgage bonds and its 300,000 shares of cumulative preferred stock.

The bonds are to bear interest of 3¼ per cent and the preferred stock will pay dividends at the rate of 4½ per cent. The underwriting syndicate consists of 112 firms.

•

SEC Restricts Dividends

Securities and Exchange Commission forbade the Metropolitan Edison Co. this week to pay any dividends on its common stock until it has accumulated $4,279,561 of earned surplus, or otherwise increased its capital by that amount. The company is part of the Associated Gas & Electric System.

•

Ohio Merger Sought

Cincinnati Gas & Electric Co. and Harrison Electric & Water Co. have applied to the Federal Power Commission for approval of a proposed merger of the Harrison Electric & Water Co., Hamilton Service Co. and the Loveland Light & Water Co. into the Cincinnati Gas & Electric Co. The four utility companies are Ohio corporations and are subsidiaries of Columbia Gas & Electric Corp. The principal offices of all the corporations are at Cincinnati and their operations to a large degree complement each other, the applicants state.

•

SEC Orders United Light to Simplify

Securities and Exchange Commission has called on United Light & Power Co. and certain of its subsidiary holding companies to simplify their corporate structures in accordance with provisions of the Public Utility Act of 1935.

SEC's order, issued under Section 11(B)(2) of the utility act, named United Light & Power Co., the United Light & Railways Co., American Light & Traction Co., Continental Gas & Electric Corp., United American Co. and Iowa-Nebraska Light & Power Co.

The board ordered a public hearing for January 14 to consider the case. This hearing, it was announced, will be consolidated with a hearing on United's application now pending for approval of a plan of recapitalization and simplification.

The report declared: "The facts and considerations . . . indicate that the corporate structure of each of the major holding companies in the United Light & Power Co. holding company system is unduly complicated. With the possible exception of American Light & Traction Co., the capital structures of each of these holding companies systems is overburdened with debt and preferred stock . . ."

•

Exchange Time Extended

Standard Gas & Electric Co. has extended the time in which its notes and debentures may be exchanged for common stock of the San Diego Gas & Electric Co. to January 15.

Utility Reports

	Net Income 1940	1939
*Alabama Power	$3,096,825	$4,074,331
†American Power & Light and subs.	12,559,021	9,914,713
*Consumers Power	10,953,591	9,425,266
*Georgia Power	4,134,119	5,343,758
*Idaho Power	1,478,164	1,546,414
*Kansas Gas & Electric	1,473,781	1,161,994
*Louisiana Power & Light	1,033,633	1,037,320
*Minnesota Power & Light	1,370,396	1,337,749
*New Orleans Public Service Inc.	2,616,947	1,889,011
*Pennsylvania Power & Light	8,818,549	8,503,033
*Ohio Edison	4,086,780	4,218,001
*Texas Electric Service	1,439,756	1,267,707

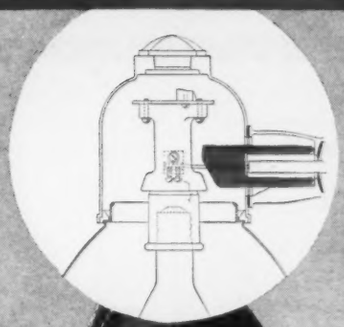
*Twelve months ended October 31.
†Twelve months ended September 30.

How a Porcelain Cylinder Keeps Cable Cool in the New Form 101

NOW, for the first time, you who have been concerned about high-wattage luminaires can be sure of safe cable temperatures. Our new Form 101 luminaire—with the same light-distribution characteristics and general appearance of the Form 81—protects the rubber by providing heat insulation. A wet-process porcelain tube within the slip fitter prevents severe cable overheating and provides added insulation between the conductors and the metal hood. Tests show that the hottest point on the rubber insulation is 55.5 C (ambient) with a 15,000-lumen lamp.

Steps in the reflector—offsets which redirect radiant energy slightly to one side of the focal axis—eliminated high-temperature problem No. 1 by reducing temperatures at the lamp stem. Now, a porcelain cylinder has stopped the annoyance and expense of high-temperature problem No. 2. No high-voltage, rubber-insulated cable will withstand more than 76 C without a serious reduction in the life of the insulation . . . yet temperatures 40 C above the permissible maximum are not uncommon in conventional luminaires with 10,000-lumen lamps, 22 C with 6000-lumen lamps.

For those who want a smaller luminaire, there is the Form 79 with the "heat insulating" hood. Add the advantage of low cable temperature to the previous advantages of more light on the pavement, lower initial cost with little glassware breakage and maintenance, freedom from dust—and the improved Form 79 will be your choice. Start now to get the benefits of this improved luminaire. If you already have Form 79's on your properties, they can be changed-over with new hoods. Or if you are planning a new installation, consider the Form 101 with 10,000- to 15,000-lumen lamps or the Form 79 with smaller lamps. General Electric, Schenectady, N. Y.



The "heat-insulating" hood has a porcelain cylinder through which the cable passes. Results—low cable temperature and added dielectric strength. The hood is adapted for Form 79 reflector and globe.

Form 101 which combines the "heat-insulating" hood with the reflector, casing, and globe of the Form 81. 500-watt or 15,000-lumen lamps can be used.

Temperature rise, C		
Location	Form 79 10,000 L.	Form 101 15,000 L.
Copper wire at binding post	82	76.5
End of main cable	46	30.5
End of porcelain insert	71	64
Base of lamp	139	136
Binding-post screw	86	86.5
Top of globe	61	40
Bottom of globe	38	17.5

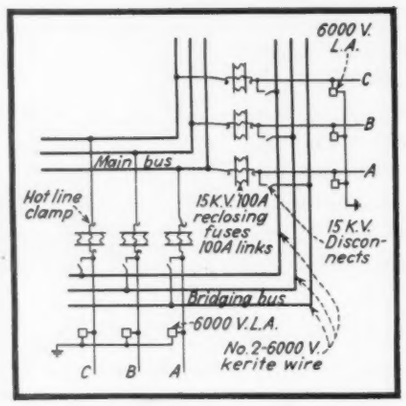
GENERAL ELECTRIC

OPERATING PRACTICES

Bridging Bus Aids Fuse Maintenance

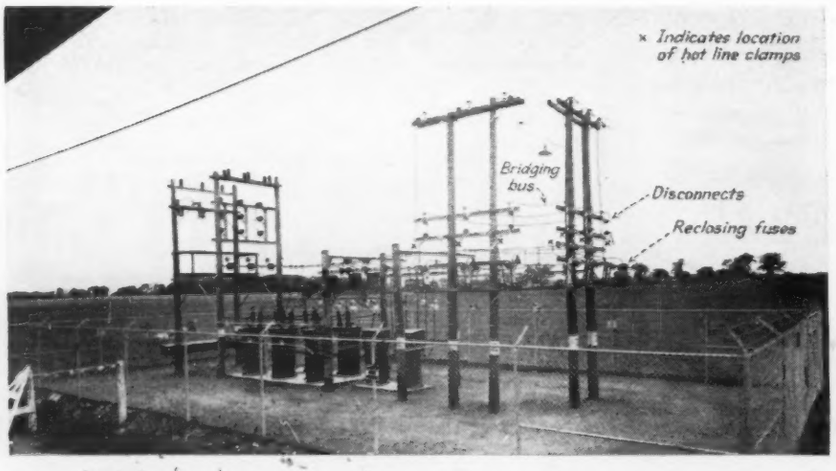
A simple "bridging bus" that allows two outgoing 4.8-kv. distribution feeder circuits to be operated through one set of three-shot, automatic reclosing fuses while the other set is de-energized for maintenance is used at the Ixonia substation of the Wisconsin Electric Power Company and has proved to have considerable practical merit.

Location of Ixonia substation in an out-of-the-way area dictated the use of reclosing cutouts to keep down refusing costs. Even repeating fuses, however, can be rendered inoperative by birds and other pests unless they are periodically inspected and maintained. The bridging bus and disconnect switches arrangement shown in the diagram makes maintenance easier by allowing one group of fuses to be removed from service at a time, without killing the distribution feeder or depriving equipment of protection by bridging the fuses.



BRIDGING BUS allows operation of two feeder circuits on one set of reclosing fuses while the other set is de-energized for maintenance

To remove either set of fuses from service all that is necessary is to close both sets of disconnect switches, in effect solidly connecting the load side of the fuses together. Either set of fuses may then be removed from service by disengaging the hot line taps that connect it to the main and bridging bus. The remaining set of fuses temporarily protects both circuits. To restore the fuses to service the taps are reattached and the disconnect switches opened, de-energizing the bridging bus.



IXONIA SUBSTATION bridging bus is between the two poles at extreme right

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Material Conserved in Vermont High Line

Simplicity of design and rugged construction feature 102 miles of 46-kv. transmission lines built on the Central Vermont Public Service system since 1935, with typical pole-top layouts giving marked economy in space and minimizing pole lengths. The type of tangent pole construction used gives a balanced loading unavailable where two conductors are located on one side of the pole and one on the other. The general wire configuration is advantageous in cold climates as the wires are in one plane, thus avoiding trouble often resulting from locating one conductor above the other in places exposed to sleet and snow.

In the latest construction No. 3 Western red cedar poles (Pentrex treated butts) carry No. 4/0 A.C.S.R. conductors based on a tension of 2,000 lb., the ruling spans being 350 ft. and the average 275 ft. Wood guy strains are used and the two-pin crossarms are 10 ft. long by $4\frac{3}{4}$ x $5\frac{3}{4}$ in., with steel pins and wooden braces. The middle wire is attached to a malleable iron pole top pin designed many years ago and having three bolts, one through the center and one through each quarter of the pole, which ties the top of the pole to prevent splitting in any direction. Angle-pole construction is of the bell type, using dead-end or suspension

WHY INHERENT ACCURACY ON HEAVY LOADS?

A WATTHOUR meter with *inherent* accuracy on heavy loads is desirable because such a meter requires little compensation to achieve straight-line characteristics. This is important because exact and complete compensation is practically unobtainable. Thus, the aim in meter design is to reduce errors—and therefore, the need for compensation—by making the unit inherently accurate.

Since the chief cause of *inherent error* in registration of heavy loads is the damping torque resulting from the current-coil flux—and this error is directly proportional to the rotor speed—it stands to reason that a meter with low nominal speed and low useful current flux is inherently accurate on heavy loads.

And that is why these features—characteristic of General Electric meters since 1926—still are the basis of the inherently accurate I-30 line.

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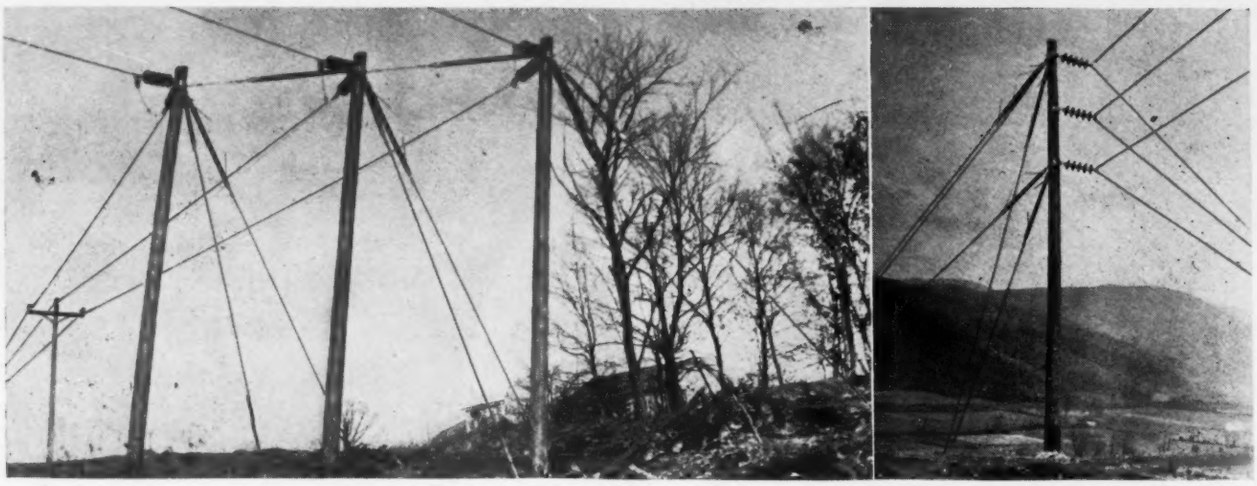
GENERAL ELECTRIC



ANGLE TURN and tangent construction on 46-kv. circuit (left). **Typical pole-angle construction in mountainous section (right)**

according to angle. Pole band attachments are used instead of eye-bolts.

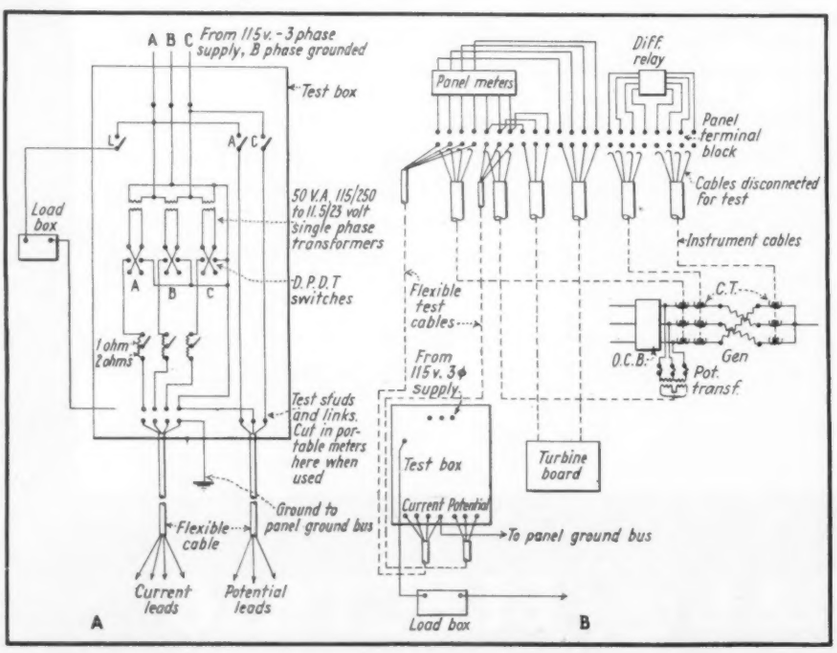
Insulators designed to be radio-proof are used, several makes being employed. Some saving in time required to run conductors is obtained by the use of clamp-top insulators. Aluminum tape is used at all clamp-top positions. Conductor wear from tie wire rubbing is prevented, hot line work is facilitated and a permanent, flexible connection is provided. Results from the radio-interference standpoint have been gratifying. The lack of high broadcasting signal strength in Vermont necessitates using high amplification in receiving principal programs, so that quiet lines are especially desirable.

Test Box Checks Switchboard Wiring

By E. E. JONES
Chief Engineer Mound City Electrical Engineering Company, Pekin, Ill.

Set up in the operating room convenient to the panels, this test box saved much time in checking the wiring on a new switchboard for a 350,000-kw. power station. The circuits of the test box were supplied from a 115-volt, three-phase supply with B phase grounded. Connections were made from the test box with flexible cables to the terminal blocks, the instrument cables being disconnected and the test cable clipped on the terminal block studs. In the test box the voltage is stepped down from 115 to 11.5 volts by three single-phase transformers, the current then passing through a single-pole, double-throw switch connected between a 1 and 2 ohm resistance. If this switch is open there is minimum current, when up intermediate current and down maximum current passing through.

When testing the relay panel the load box is used to operate relays having coils with high impedance, connecting to each phase at the test studs. The double-pole, double-throw switches must be open. Using the load box eliminates the step-down transformers, giving a higher current than the rated meter current, and thus making it possible to test the relays.



INTERNAL CONNECTIONS of test box used for checking wiring of new panelboard (a) and (b) use of test box on generator panel

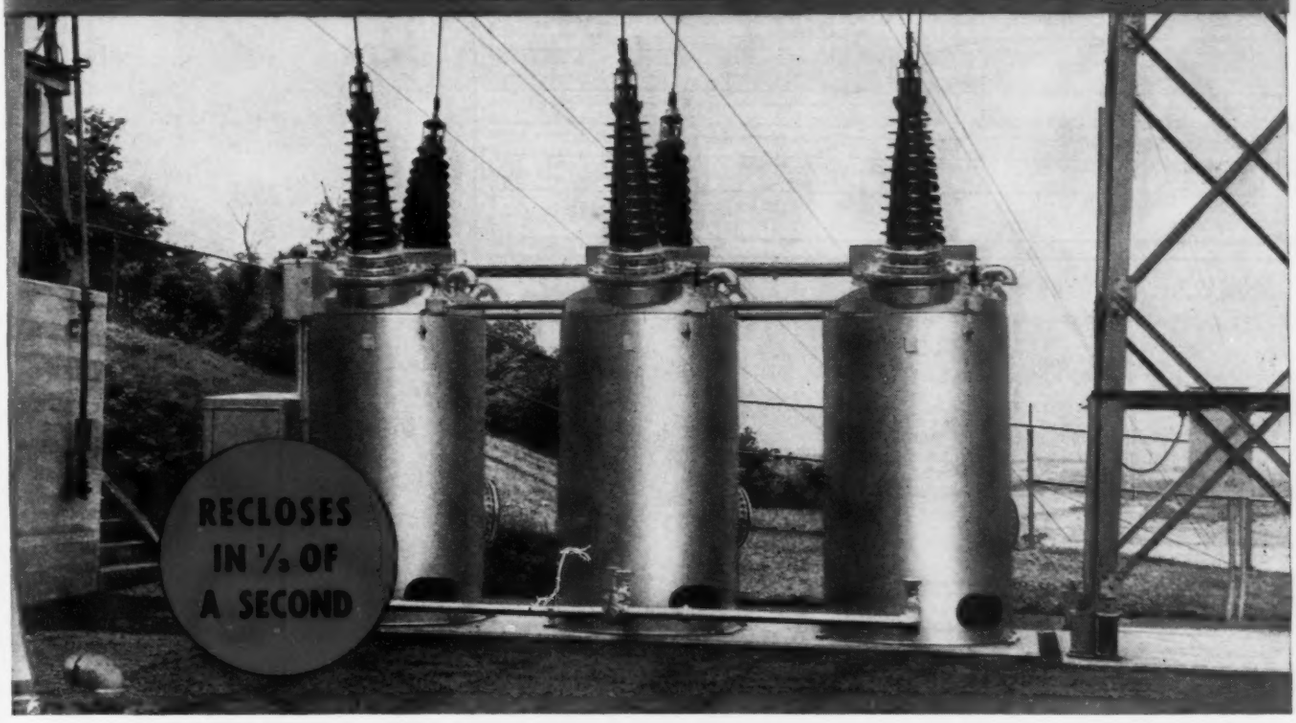
Conflict Chart Shows Relations of Feeders

By LEWIS G. McDOWELL*
Consolidated Edison Company of New York, Inc.

The primary purpose of the "Feeder Conflict Chart" is to show the relations of feeders which are associated in the supply of energy to the secondary network through network distribution transformers. A separate chart is made up for each feeder and all associated, or conflicting, feeders are listed on that chart. Five types of conflicts may be used, two for isolated networks supplied from three feeders or less and three for larger networks supplied from

*Excerpted from E.E.I. paper entered in the James H. McGraw prize contest for meritorious engineering papers.

SUPER-SPEED RECLOSING



. . . Already Proved by 60 Breaker-Years of Experience with G-E Installations

SUPER-SPEED reclosing of your large oil circuit breakers is of greater importance today than ever before. The heavy schedules of increased industrial production make it necessary for you to provide the best possible service continuity. That means ***super-speed*** reclosing.

Fortunately, we are well prepared to meet today's requirements. Recognizing the need for ***super-speed*** reclosing, our engineers made the first application of a high-voltage, outdoor oil circuit breaker with a super-speed reclosing mechanism five years ago and proved its practicability by successful field tests. This breaker, a Type FHKO-339, operating on a 138-kv, 60-cycle circuit, recloses within 20 cycles (⅓ second) after energizing of the trip coil to start the open-close operation.

G-E breakers with this ***super-speed*** reclosing mechanism have established an enviable service record. Already sixty breaker-years of experience have been accumulated, demonstrating clearly the reliability of this type of equipment.

We recognize the fact that developments of this kind—which anticipate your operating requirements—are made possible only through the co-operation of your executives, engineers, and operating men. We urge you, in the interest of progress which contributes greatly to the quality of your own service, to consult with our engineers when you are studying circuit breaker problems. General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC

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FEEDER CONFLICT CHART

CONFLICTING FEEDERS								CONFLICT			BIFURCATED FEEDER 107	SHEET 1 OF 1 SHEETS	FEEDER NUMBER 102
101	105	106	112	113	116	117	125	DELTA-WYE	WYE-WYE	DELTA-DELTA	LOCATION OF CONFLICT		NOTES
	S			S	S						Boulevard Substation		
	C		C								ABC Corporation - Ave D & 23 St.		
•									O	O	Ave A - 1 St to 25 St.		
•			•	•				X	X	X	Ave A to Ave B - 1 St to 25 St.		
•			•	•					X	X	Ave B to Ave F - 16 St to 31 St.		
•										O	Ave F - 16 St to 31 St.		
•					•	•			X	X	Ave F to Ave G - 16 St to 31 St.		
•						•	•		O		First National Bank - Ave K & 26 St.		
			•	•				■	■	■	XYZ Corp. - Ave A & 95 St.		
						•				O	Ave K - 81 St to 83 St.		
•						•	•	X	X	X	Ave K to Ave M - 78 St to 85 St.		

ISOLATED NET WORK
THREE FEEDERS OR LESS

DATE EFFECTIVE		NETWORK AREA	SOURCE	BUS	KV.
Feb. 28-1940		Central	North River	3	13

NOTES:-

FEEDER CONFLICT CHART for isolated network, three feeders or less. Locations where conflict exists between the two feeders are represented by asterisks under the number

four feeders or more. These conflicts and their symbols are as follows:

1. Solid triangle—simultaneous outages of two conflicting feeders resulting in interruption of service to the network (two-feeder isolated network).
2. Solid square—simultaneous outages of three conflicting feeders resulting in interruption of service to the network. (A three-feeder isolated network.)
3. Solid circle—outages of two conflicting feeders, simultaneously, which will result in voltages below, or loading above, second contingency (two feeders out of service) design limits.
4. "O"—simultaneous outages of two conflicting feeders resulting in voltages below, or loadings above, first contingency (one feeder out of service) design limits.
5. "X"—simultaneous outages of three conflicting feeders which will result in voltages below, or loadings above second contingency design limits.

At no time during the period of conflict may simultaneous outages of two feeders be scheduled for conditions 1, 2 and 3. Simultaneous outages of two feeders may be scheduled if necessary for 4 when one of the feeders is to be out of service for a short time only, such as for switching operations, during the period of conflict; for condition 5 when one of the feeders is to be out of service for work which will permit restoration of service in a short time in the event of the loss of a third conflicting feeder during the period of conflict.

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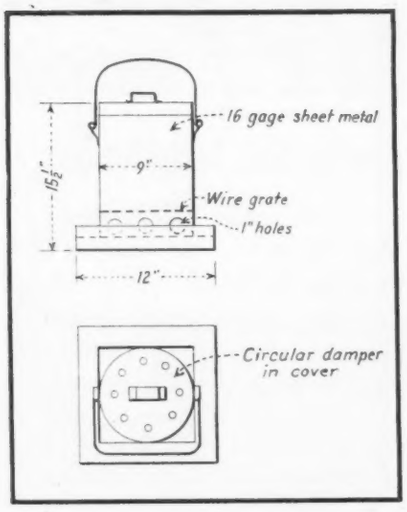
Charcoal Brazier Keeps Linemen Warm



Even during the mild Texas winters around Dallas the hands and feet of linemen working for long periods on distribution poles become chilled. With proper concern for the comfort of their men, therefore, the Dallas Power & Light Company has built a number of sheet-metal charcoal braziers, which can be run up the pole on a hand line (or for that matter left on the ground) to permit the men to get warmed up occasionally. For obvious safety reasons the hot braziers are not left on the pole top for a longer time than is required to remove the chill.

Tower Repaired With Line Hot

Concrete foundations of a 110-kv. tower line of the Central New York Power Corporation were recently repaired without de-energizing the line. The A-frame tower, properly anchored by side guys, was tipped first on one leg, then on the other, the legs set on channel irons and the tower then skidded to a log foundation. When the new concrete in the foundation had dried the tower was skidded back into place.

•

"Hurry-Up" Service With Light Trailer

Night trouble crews of the Public Service Company of Oklahoma have found that with the light transformer shown, attached to a pick-up truck, they can run out to a trouble spot and restore emergency service usually in one-half hour, instead of taking two hours to change a damaged or burned-out transformer. Having restored service, they leave the actual transformer change to the regular line crew.

Also used for routine transformer change-out operations, the trailer, which is 3 ft. wide, 4 ft. long and 3½ ft. high from hub to top, houses a 25-kva., 2,400-120/240-volt transformer cutouts and accessories.

Both primary and secondary cable are brought into the transformer compartment through retractable conduit, which, when the trailer is in use, extends 10 ft. above the ground,

TRAILER, costing $250, used with pick-up truck to give emergency service, houses 25-kva. transformer

keeping the cables out of reach of the public. For primary cables two 40-ft. lengths of No. 4 Simplex Tirex cable are used, and for the secondary cable a 35-ft. length of similar No. 2 three-conductor cable. Both primary and secondary cable is fitted with hot line taps.

The unit has been in use less than a year and will be supplemented by two others, housing a 37½- and a 15-kva. transformer each, it is planned.

MONEY-SAVING FEATURES!

New Allis-Chalmers Distribution Transformer First With Cost Cutting Improvements!

Added quality in every detail . . . added design features that point the way to greater all-around dependability at lower costs — that's the new Allis-Chalmers Distribution Transformer . . . on the market today!

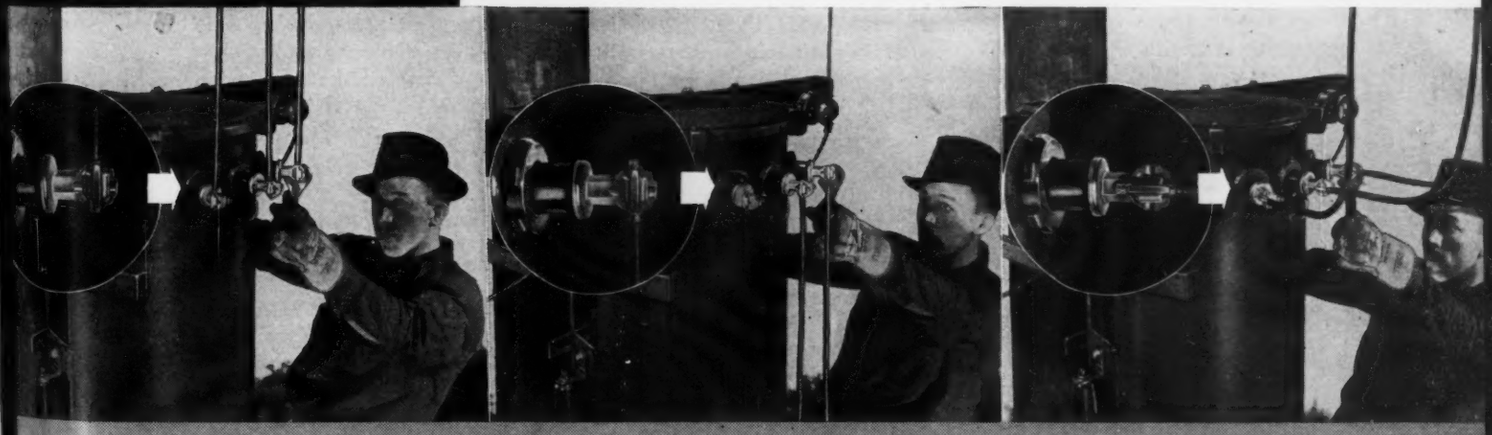
With the big cadmium-plated 3-way terminals you save man hours . . . eliminate complicated wiring jobs.

Equally important . . . you don't have to buy special fittings . . . for the heavy cadmium plating not only reduces corrosion . . . but at the same time actually minimizes electrolytic action when used with copper or aluminum conductors.

What's more, there's new design perfection of core and coils . . . dictated by over 40 years of Allis-Chalmers experience in building distribution and power transformers for utilities all over the world. All windings are double insulated for added safety — double protection against winding failure.

But that's only part of the story! This new Allis-Chalmers Distribution Transformer . . . with all its money saving features costs no more than ordinary distribution transformers.

For complete information . . . call the nearest Allis-Chalmers District Office . . . or write Allis-Chalmers, Pittsburgh Works, Pittsburgh, Penn.



SEE HOW THE NEW 3-WAY TERMINAL WORKS! Perfected 3-Way Terminal is standard equipment on all new Allis-Chalmers Distribution Transformers. First and second pictures show how simply and easily leads can be brought to the transformer from both top and bottom. But you don't stop there! For in the third picture is illustrated an *extra* advantage you get with no other terminal! If necessary . . . leads can be brought straight out from the transformer . . . without making an extra bend in the conductors or complicating the wiring job. Notice how the tightening tool travels in an *up and down* direction eliminating the chance for accidental short circuits across the secondary terminals. Notice, too, that a standard line-man's wrench is used. No special tools are needed. You don't have to buy extra fittings. Heavy cadmium plating of the 3-Way Terminal makes it possible to be used with *both* copper and aluminum conductors with a minimum of electrolytic action. A-1231

TRANSFORMERS *Cut Operating Costs*

INDUSTRIAL ENGINEERING

Fire Prevention Grows in Importance

Bottlenecks in defense material production caused by fires deserve closer attention, according to a recent report on field conditions by Factory Mutual engineers. Industrial ovens, electric or otherwise, must be safeguarded against fire or explosion.

Given adequately protected wiring, a primary essential is to prevent the formation of explosive mixtures produced either where gas is used for oven heating or where inflammable vapors are given off from dipped material being dried or baked. Ventilation must be carefully planned, removing vapors fast enough during the bake to prevent any vapor-air mixture inside the oven from reaching the lower limits of explosability. Complete new oven units are now available on the market with approved designs, and automatic control devices can be adapted to existing installations.

Oven safety devices should be inspected frequently and maintained carefully. Oven doors are good explosion vents if not securely latched but merely held by friction catches, and in addition, oven roofs wherever possible should be constructed of light, unfastened panels which would be readily lifted if an explosion occurred. Much work has been done of late by these engineers in co-operation with oven manufacturers along the following lines: (1) Determining safe ventilation requirements; (2) developing an inflammable vapor indicator; (3) investigating safe heating methods; (4) testing and helping develop numerous automatic devices; (5) establishing standard control wiring circuits; (6) developing standards for complete oven units.

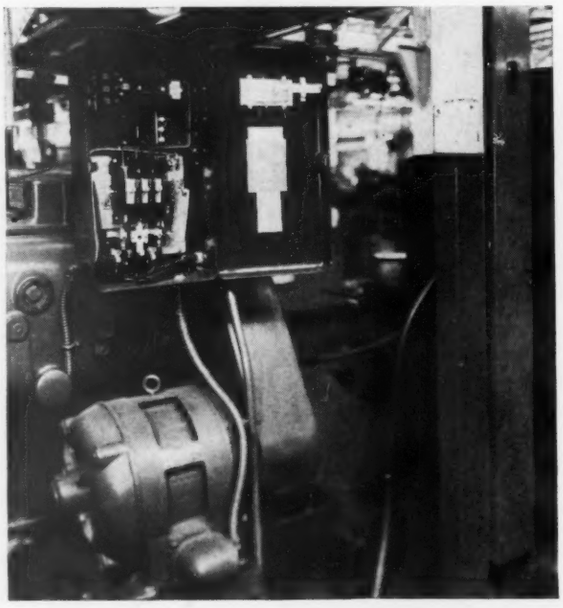
This organization continues to study the causes of fires in industrial plants and many of these occur from relatively minor reasons associated with both design and operation. In a typical case the absence of a protective bushing where electric wiring entered a junction box led to a fire in a textile mill picker room with a two-hour shutdown. Vibration caused the metal edges of the hole to cut into the wire insulation, producing an arc and sparks which ignited a storage of cotton laps.

In another plant, mainly of fireproof construction, a $2,000 fire occurred because a maintenance crew using an electric welder on an overhead crane overlooked the danger of sparks igniting a small shop office of wooden construction located below the crane run. These examples point to the continuous importance of including fire hazards in the routine studies of engineering and operating departments, in co-operation with the insurance organizations. New combinations of adverse conditions are frequently arising in the operation of industrial plants, and the relation of electrical installations and their use to these hazards warrants unceasing thought to prevent even minor troubles.

•

Combine Controls at Machine Unit

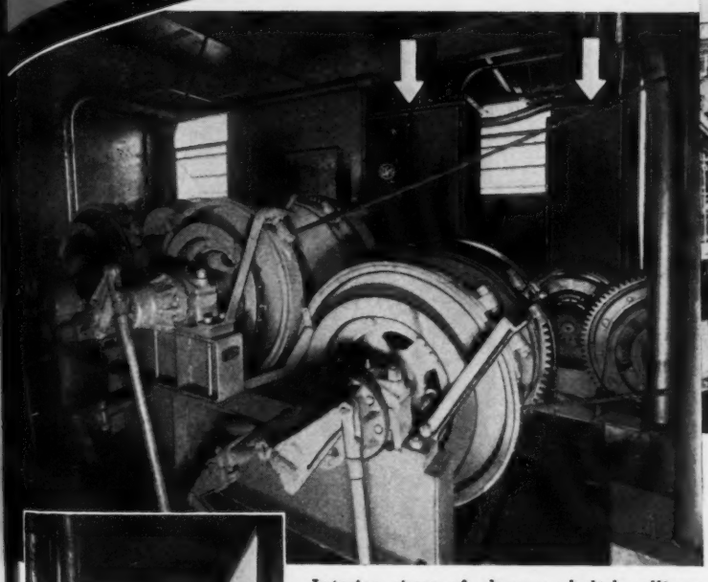
In expanding the plant of the Heald Machine Company at Worcester, Mass., to meet increased production requirements special attention has been given to saving space in the vicinity of aisles and on tools turning out the company's own material. At the turret lathe shown herewith, driven by a 15-hp., 550-volt, three-phase induction motor, it is desirable from time to time to operate local lamps associated with the tool itself. These are now served integrally with the machine tool from a 120-volt transformer mounted in a control cabinet which also contains a manually operated (short-circuit actuated, in emergency) switch, a 550-volt magnetically operated motor switch, a polarity outlet and 110-volt push-button control for the machine tool operator.



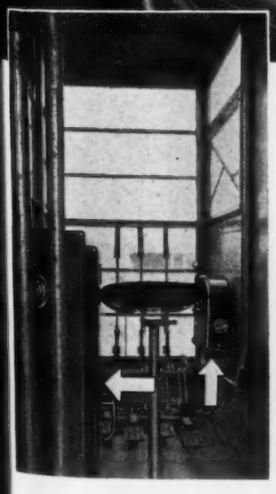
ALL electrical service at this turret lathe is supplied from this combination cabinet mounted on the frame

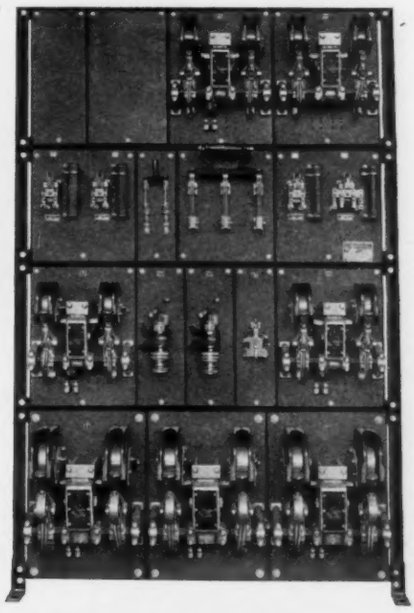
At the right of this

Now... it can be done with A-C



Interior views of above asphalt-handling crane showing EC&M Enclosed Controllers and EC&M Type NT Master Switch.





EC&M Reversing-Plugging Frequency Relay Magnetic Controller for Trolley Motion of Material-Handling Crane-Bridge.

CRANES powered with A-c motors are not new. Many are in use. They have been selected where the economies of using available A-c power have outweighed the better performance of a D-c installation. This has been particularly true of isolated installations where one or, at most, a few cranes are involved.

Highly satisfactory motors have been available for A-c as well as D-c cranes. D-c Control Equipment has been developed to a high degree of perfection — (examples, dynamic lowering control to eliminate the costly-to-maintain load-brake — the perfection of simple magnetic contactor control). ***The Development of A-c Crane Control has Lagged far behind.***

Now—the picture is completely changed. The new EC&M A-c Magnetic Control with Frequency Relays and **LINE ARC** Contactors gives results which previously had been impossible to obtain on A-c equipment. Load-brakes are eliminated by the EC&M A-c Dynamic Lowering Circuit. Frequency Relays permit weak values of torque to give ***Smooth Operation*** without danger of overspeeding. Hyper-Synchronous lowering speeds permit an A-c crane to make more trips per minute — all made possible by the use of the EC&M Frequency Control Relay.

Many installations of this control are now in service on overhead, boom, bridge and whirler cranes in steel mills, machine shops, ship-yards, cement mill, etc., service. There may be one in your vicinity which you can inspect. Write us.

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

EC&M TIME-CURRENT System for D-c Motors
FREQUENCY RELAY System for A-c Motors

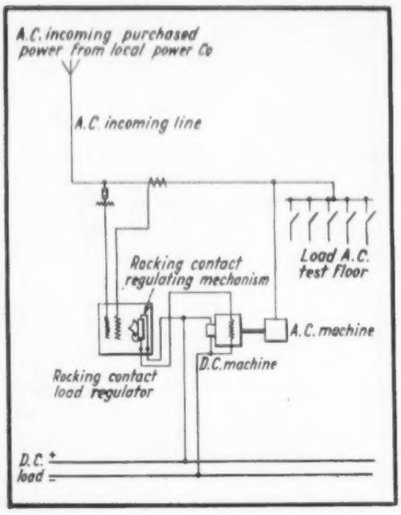
combination cabinet, which saves both space and material in serving the electrical requirements of this tool, is a typical column terminal box with a capacity of eight three-phase, 550-volt circuits which utilizes space otherwise of little value in distributing power to neighboring tools. The Trumbull Electric Manufacturing Company furnished the combination switch box to meet the requirements of the Heald company's engineers.

•

Load Regulator Solves Demand Problem

By A. M. SHONG
Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Widely fluctuating power demand in any industrial plant constitutes a serious and often avoidable drain on any plant pocketbook, since it boosts artificially the power charges out of all proportion to normal plant needs and in the face of reasonable electric rates. Various methods have been



EXCHANGE of power between separate a.c. and d.c. systems—through regulator-controlled m.g. set—smooths out swings in plant a.c. demand

used successfully in different shops to combat the condition, but one that was used by a large midwestern industrial concern has some elements that are a little out of the ordinary.

The a.c. load demand of this concern, metered on a fifteen-minute interval, fluctuated widely due to the nature of the load of a rather extensive test floor. To smooth out these demand fluctuations, in this case, a rocking contact load regulator was used in conjunction with a 450-hp. synchronous motor-generator set connected between the incoming a.c. line and the plant's d.c. shop circuit. Shop d.c. was supplied by means of a steam-driven d.c. generator.

Arrangement of the circuit is shown in the accompanying illustration. Motive element of the load regulator was made sensitive to a.c. incoming power flow from the power company's line. The rocking contact resistive element was connected in the shunt field circuit of the d.c. machine on the motor-generator set. With this arrangement power is exchanged between the a.c. and the d.c. systems through the motor-generator set automatically with fluctuation in a.c. demand, thus tending to keep the demand on the a.c. incoming line constant.

Under the desired or normal demand conditions at the a.c. incoming line the regulator motive element is balanced and it inserts the correct amount of resistance in the field to provide correct excitation to the d.c. end of the set so that there is no exchange of power from a.c. to d.c. or vice versa. However, with a rise in a.c. demand, the regulator immediately changes the excitation on the d.c. machine so that it becomes a motor deriving power from the d.c. supply. This energy drives the a.c. machine as a generator to feed power to the a.c. line and relieve the demand to the predetermined desired amount. Conversely, when the a.c. demand falls below normal or desired value the regulator causes the d.c. machine to act as a generator driven by the a.c. machine on the set, taking power from the a.c. line and converting it to d.c., thus relieving the load on the d.c. steam-driven equipment and raising the a.c. demand to the desired amount.

Safety features include a contactor to make the regulator ineffective if the a.c. machine breaker should trip out, preventing possibility of the d.c. machine overspeeding as a motor.

This sensitive control of incoming power flow is accomplished smoothly and quickly with the rocking contact load regulator. It is estimated that the device paid for itself in the first eight or nine months after it was installed by smoothing out the demand peaks and also preventing power being paid for and not utilized.

Transformer Bank for Texas Oil Field

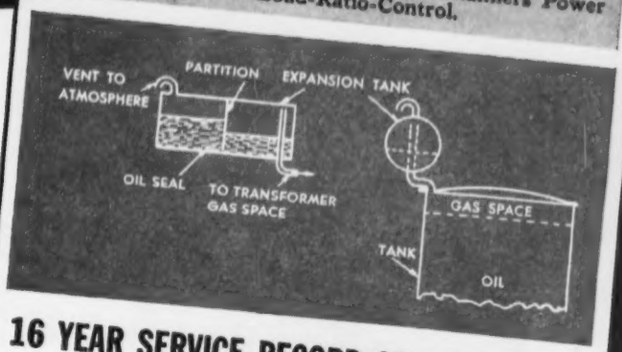
Typical of the newer substations being erected in the oil fields and pipe line terminals around Corpus Christi, Tex., is this one (a) which serves the Magnolia Petroleum Company. Its three 250-kva., 11,500/2,300-volt transformers (5,950 lb. each) were considered too heavy for rack mounting and were accordingly mounted on a 6 x 22-ft. concrete pad surrounded by shell fill (and a 30 x 12-ft. fence yet to be erected when this picture was taken). Fused primary disconnect switches are mounted on 4 x 6-in. timbers 22 ft. long that span the poles. Metering is on the secondary side at 2,300 volts.

The power company's outdoor meter box (b) contains the usual recording demand meter and three-phase watt-hour meter. In the background of (b) can be seen the 2,300-volt service line and a portion of the metal switch house which contains the secondary oil circuit breaker and distribution panel.

This plant is in the territory served by the Central Power & Light Company.

HOW TO GET INERT GAS PROTECTION WITH LESS MAINTENANCE!

LOW-COST MAINTENANCE OF OIL WITH the OIL-SEALED System is only one of the extra value features this eastern utility obtained when they installed these three 10,410 kva Allis-Chalmers Power Transformers with Load-Ratio-Control.



Allis-Chalmers Exclusive OIL-SEALED Inert Gas Protective System Maintains Quality of Insulating Oil with No Pressure Reducing Valves . . . No Mechanical Moving Parts . . . No Chemicals. Here's How You Can Reduce Inspection and Servicing Time by Using Allis-Chalmers Power Transformers!

IF YOU ARE like many utility engineers who recognize the advantages of inert gas protection but wish to avoid the high maintenance costs that high-pressure inert gas systems involve, here's money-saving news for you!

You can cut your transformer oil maintenance without running up high inspection and servicing costs . . . by using the exclusive Allis-Chalmers OIL-SEALED Inert Gas Protective System.

For the inert gas system on Allis-Chalmers Power Transformers maintains the quality of insulating oil with no pressure reducing valves to adjust or replace . . . no mechanical moving parts to get out of order or wear out . . . no chemicals to handle. All you do is blow out the oxygen in the gas space . . . place the transformer in service . . . and forget about oil sludging.

Once you've given it a trial you'll see why operators call it the "automatic system that operates without attention." And you'll like the low operating pressures (almost always less than one pound per square inch) that minimize oil seepage . . . eliminate constant nitrogen replacement.

To find out how you can put Allis-Chalmers superiority in transformer engineering to work for you, call the district office near you or write for Bulletin 1182.

16 YEAR SERVICE RECORD OF FIRST INERT GAS SYSTEM OUTSTANDING — A TRUE CASE HISTORY ON THE OIL-SEALED SYSTEM

IN 1923 Allis-Chalmers installed the OIL-SEALED System as the first commercial application of any inert gas protection to eighteen 15,000 kva power transformers for an eastern utility. At that time the oxygen was not initially blown out as is the practice today. Yet after three years of operation . . . with absolutely no maintenance or inspection . . . the average oxygen content in the gas space measured less than 2.4% in every one of the 18 units . . . oil oxidation was negligible. ***And today . . . over 16 years later . . . those transformers are still giving maintenance-free service protected by the exclusive OIL-SEALED Inert Gas System!*** A 1221

Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

ALLIS-CHALMERS

MILWAUKEE·WISCONSIN

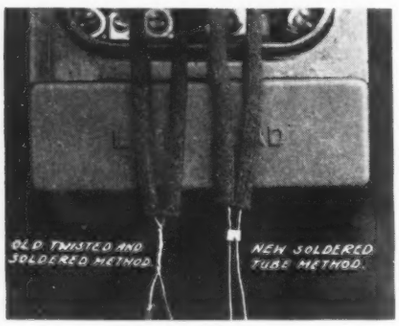
NEW ENGINEERING IDEAS

Copper Tubing Speeds Meter Lag Adjustment

By L. H. SAUMENIG
Philadelphia Electric Company

A small piece of duplex copper tubing made for telephone work has proved very handy as an adjustable soldered clamp when used on the power factor loops of certain watt-hour meters at the Philadelphia Electric Company.

In adjusting the watt-hour meter on inductive load a hot soldering iron is applied to the duplex copper tubing, permitting it to be moved the desired amount in either direction. When the iron is removed from the tubing it is soldered fast and maintains its position. This device has proved an improvement over the twisting and untwisting of the two wires, unsoldering and resoldering them. It not only is faster but is more convenient and does not subject the wires to breakage and consequent expensive repairs to the meters.



OLD METHOD of soldering lag coil leads (left); new sleeve method (right)

The tubing is made from 0.020-in. flat copper bent in the form of two adjacent tubes and joined in the center. The inside diameter is 0.055 in. and outside 0.095 in. cut to lengths of $\frac{3}{16}$ in. They are known as 1-45 x 0.032 copper sleeves A. T. & T. spec. No. 6030.

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Floating Power Plant for Wartime Needs

By ANDREW P. KELLOGG*
Turbine Engineer, General Electric Company

Considerable impetus has been given the development of portable electric generating equipment by the rapid growth of concentrated loads due to national defense preparation and the desire for some means of assuming load immediately if generating station facilities are damaged by bombs in time of war. Portable generating units comparable in size to standard central stations are desired and it is believed that they are practical. As an auxiliary to the National Defense Program the value of such units would be great as additional power could be made immediately available for replacing damaged facilities or increasing production.

That ships are practical as portable electric power generating stations was shown when the aircraft carrier *Lexington* supplied much-needed power to the city of Tacoma, Washington, in 1929 when a shortage of water reduced the power supply. Also, since 1930 the 20,000-kw. power-ship *Jacona*, commissioned by the Public Service Company of New Hampshire, has been operating on the Piscataqua River near Portsmouth, N. H. This floating power station houses two 10,000-kw., 3,600-r.p.m. turbo-generator units, four B & W marine-type boilers, capacity 280,000 lb. of steam per hour at 425 lb. pressure and 250 deg. superheat.

A study of a projected 50,000-kw. self-contained floating power plant has been made by the General Electric Company and the layout is shown herewith. A large portion of the eastern United States and the West Coast could be reached with a barge which could pass through the New York State barge canal. With these limits in mind, dimensions were limited to an over-all length of 290 ft., beam 43 ft., draft 10 ft. and low bridge clearance of 15 ft. In these dimensions it has been possible to contain a net capacity of 50,000 kw.

Equipment for the proposed floating power plant in general closely follows standard marine and central station practice with modifications necessary to meet the low headroom. Boilers similar to the standard oil-burning, marine type have been selected for the study, with the addition of an air preheater and a somewhat smaller economizer. Four boilers are used. Stacks would be made with separate connection, permitting removal for transportation under bridges.

The turbine generator is rated 50,000 kw., tandem compound, double flow with side exhausts. Initial steam conditions would be 825 lb. gage pressure, 900 deg. total temperature. Four stages of extraction would be employed for heating feedwater and the deaerator and evaporating make-up water.

Generator would be rated 50,000 kw., 0.8 p.f., 62,500 kva., three-phase, 60 cycle, 13.8 kv. Direct connected to the main generator would be a house generator rated 3,500 kw., main and pilot exciters and a house

*Abstract of paper before electric section meeting, Wisconsin Utilities Association, Milwaukee.

ALTER EGO: Literally "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

ALTER EGO: How many have offered you a "good-as-Fleetweld" rod . . . and are they confessing or bragging?

Well, here's the third different welding rod proposition that lays eloquent emphasis on the claim that it's as good as "Fleetweld." *That's stimulating.*

ALTER EGO: No, it's emulating. Emulation admires and strives to imitate great actions. It's a human trait.

That prompts me to ask myself—"Why is 'Fleetweld' taken as the standard of welding electrode comparison?"

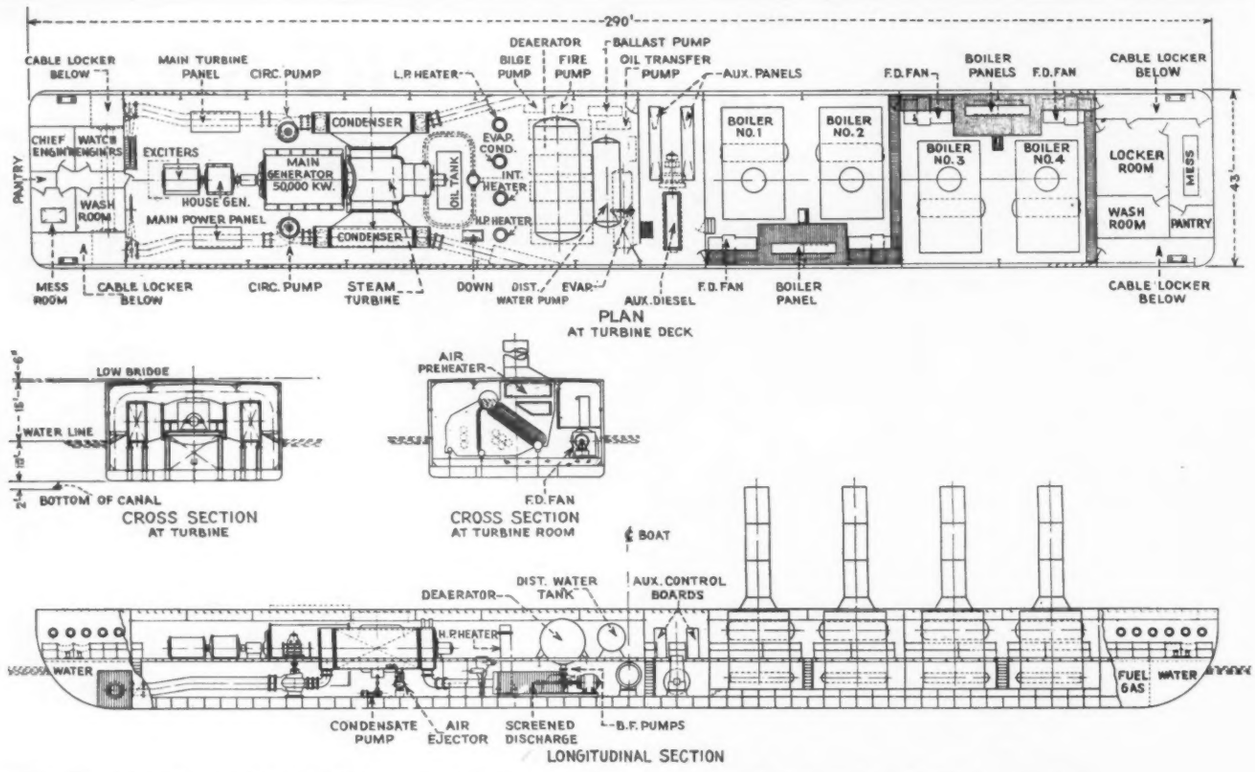
ALTER EGO: Maybe Lincoln can give us the FACTS and we can judge for ourselves.

• •

LINCOLN SUGGESTS: To find out why "Fleetweld" is the standard of comparison for welding quality and economy, TRY IT! Compare it to other electrodes. In what ways? See the 30-Point Check Chart on Page 5 of the New "Weldirectory." This 56-page procedure guide (gratis) gives all the FACTS about 37 Lincoln Electrodes for welding and hard-surfacing—where to use them—how to use them—what weld properties to expect.

LINCOLN "SHIELD-ARC" WELDING THE LINCOLN ELECTRIC COMPANY Cleveland, Ohio

Largest Manufacturers of Arc Welding Equipment in the World



HYPOTHETICAL LAYOUT for 50,000-kw. floating power plant to replace bombed generating facilities in wartime

exciter. The main generator would be hydrogen-cooled, with the surface gas coolers within the generator casing. The cooling air for the house generator would be cooled by a surface air cooler.

Condensers would be horizontal tube, single pass, similar to the usual central station design, excepting that the steam connections would be at the side. Auxiliary equipment would be similar to that in the usual central station.

To start from cold, there is included an auxiliary Diesel-powered generator of about 500 kw. capacity. When being towed it is probable that some lights and a slight amount of power would be required. For this there would be a gasoline-driven or Diesel-driven generator of perhaps 20 kw. capacity.

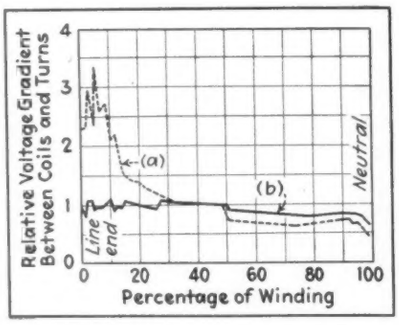
It is expected that the operation of such a power plant would be comparable with that of a good modern central station. The performance at full load is estimated at about 12,500 B.t.u. per kw.-hr. This is on the basis of power output from this barge and includes all auxiliary requirements.

On many of the large systems the yearly station demands are not coincident, and if one or more of these units were available it could be moved from power house to power house as load requirements dictate. On the larger systems, where it is known that the total load will grow during the next two or three years, but the most economical location for a new generating unit is difficult to predict, one barge could be used until the load has actually grown at any given point.

•

Protect Transformers by "Stress Control"

Local concentration of stress is, in general, the cause of damage to transformer windings due to high voltage surges on transmission lines, resulting from lightning or other disturbances. Reinforcement of the insulation at points known from experience to be relatively weak is frequently ineffective, and consequent failures have occurred in the adjacent ordinary insulation.



CURVES show surge stress distribution in (a) standard wiring; (b) "stress-control" windings, as taken from cathode-ray oscillograph measurements on a 5,000-kva., three-phase, 33-kv. transformer with a 0.2/40-microsecond incident impulse

In a new "stress control" design by Ferranti, Ltd., Hollinwood, Lancashire, England, states *Electrical Review*, the essential requirement taken is not necessarily uniform voltage distribution, but uniform voltage gradients or stresses; *i.e.*, equality of voltages between turns and coils throughout the winding is immaterial as long as the insulation is in proportion and is appropriately increased where the maximum voltages are relatively high.

Voltage distribution is largely determined by the insulation between turns and coils, and this insulation determines the electrical strength. By co-ordinating these values the surge coil and turn voltages, while not necessarily uniform throughout the winding, can be proportioned to the insulation strength at every point, resulting in substantially uniform stresses. Thus the insulation actually providing the electrical strength is used as a convenient means of controlling the corresponding electrical stresses.

30 Years of This Test "OK's"

L-M HARDWARE

Blistering heat waves, blustering blizzards—thirty years of them—have tested L-M Hardware and stamped it "OK." High strength steels, careful machining, thorough galvanizing make every L-M clevis, clamp and pin equal to the strains of changing weather and passing years.

Now, with dependable equipment needed more than ever before, the time tested, proved-on-the-line dependability of L-M Pole Line Hardware deserves your investigation. You'll find the L-M Hardware and Construction Specialties Line complete—including everything you need from pole top pins to anchors. You'll find, too, that conveniently located L-M warehouses insure prompt delivery to stock room or job.

LINE MATERIAL CO.
MILWAUKEE • WISCONSIN

LOAD BUILDING

New Orleans Tries Direct Expansion

Overcoming several unusual refrigerating problems in freezing a temporary 7,400-sq.ft. ice rink during midsummer for New Orleans' first ice carnival required skill and engineering ingenuity. First cost was reduced, time saved and operating expense lowered by applying direct expansion of Freon in copper tubes embedded in the rink tank, instead of the originally proposed brine system. The entire installation, using two 60-hp. hermetically sealed condensing units for freezing a 1-in. thick crust of ice on the rink, was completed in the record-making time of 7½ days. This is believed to be the first and only direct expansion refrigeration system for ice skating in the United States.

The two-week ice carnival was staged in the largest centrally located auditorium and it was necessary that any brine cooling system be located outside the building. Since the ice carnival was a short-time show, the rink equipment was arranged to be put in and taken out without trouble and damage to the auditorium. The first idea was to locate compressor equipment and brine tanks on railroad cars placed on a siding at the rear of the building. This led to many difficulties and much expense.

Chief Engineer Walter Taylor of the Equitable Equipment Company suggested the startling idea of using Freon refrigerant refrigerating equipment and freezing the rink ice by direct expansion of this refrigerant in copper tubes in the rink water tank. Cost estimates indicated that this could be done more cheaply than the original plan and would result in a cheaper operating cost. The new idea was accepted and by careful planning and co-ordination the installation was completed in a trifle more than a week.

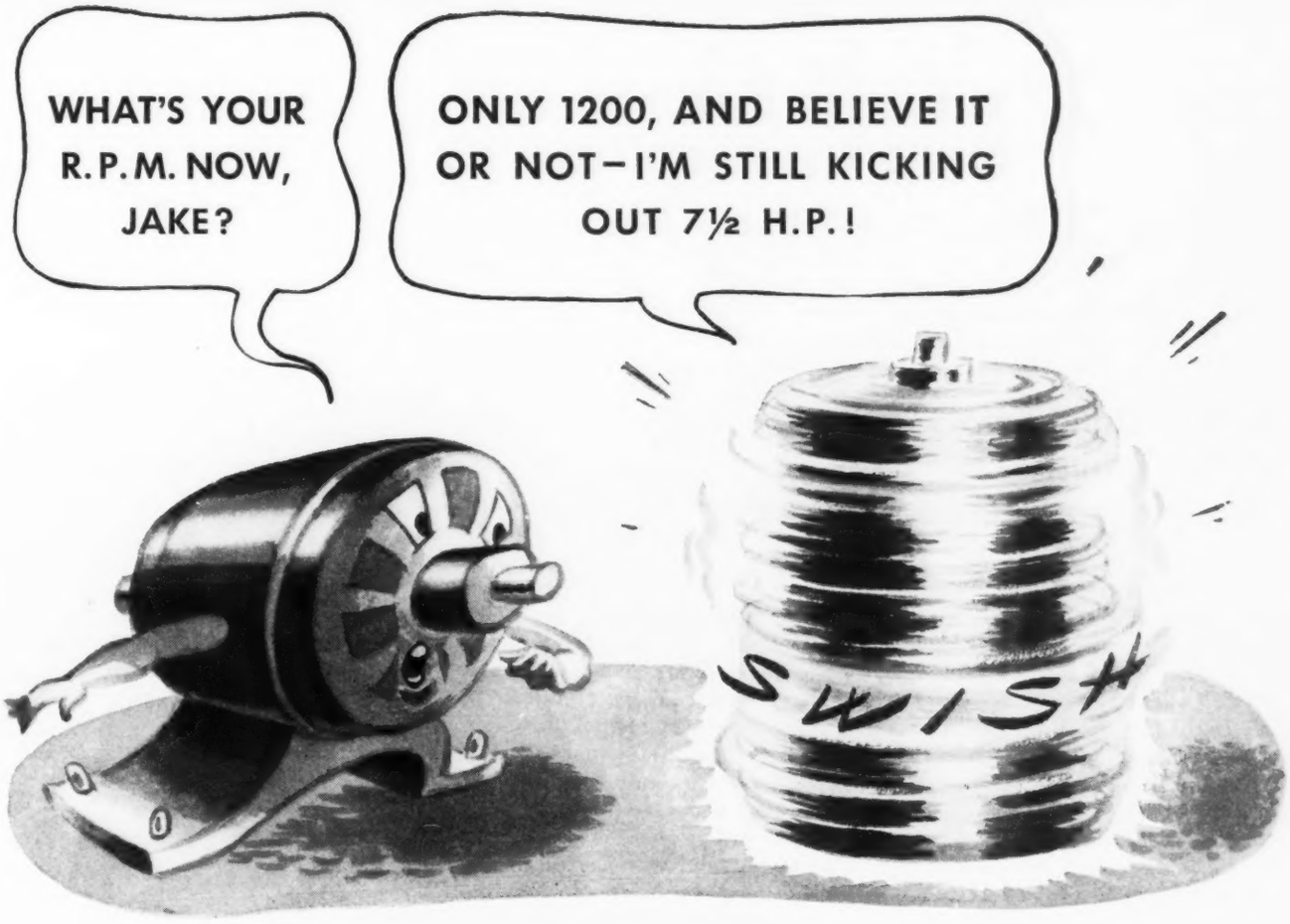
The rink was 61 ft. wide and 120 ft. long, with an extension on one side as an entrance 5 ft. wide and 20 ft. long. A 9,200-lb. galvanized tank of these dimensions was made with approximately 100 linear feet of locked and soldered joints. First an insulation pad of resin paper, a layer of 1-in. locked roofing Celotex, a layer of 15-lb. tarred felt and finally another layer of locked 1-in. roofing Celotex was put on the auditorium floor. The water tank sat on this insulation pad. A 6-in. high framework was built up around the side of the tank.

Cooling coils consisted of 29,120 lineal feet of ⅝-in. O.D. type L copper tubing of 20-ft. lengths. These tubes were spaced on 3-in. centers and made up in coil sections of sixteen tubes, 60 ft. long, 3-in. centers. To feed these coil sections there were 30 expansion valves of the multiport type.

The 74-ton refrigerating system consisted of two Westinghouse sealless Freon-12 condensing units located in the basement. Each unit consists of a 60-hp., eight-cylinder, hermetically sealed, refrigerant-cooled motor type compressor and a water-cooled condenser. Each condensing unit weighed 4,100 lb. and measured 92⅞ in. long, 26¼ in. wide and 49¼ in. high. The space available for these units was 12x12 ft., allowing ample working and walking space around and between each unit.

Temporary electric power lines were run in from the main switchboard. Temporary water piping for

AN ICE CARNIVAL in New Orleans required a 7,400-sq. ft. ice rink in midsummer. Westinghouse direct expansion installation with 60-hp. condensing units provided one-inch ice crust



Space factor of Fiberglas* Insulation permitted same H. P. at Fewer R. P. M.

A BROOKLYN, N. Y. manufacturer of fine furniture had three motors side-by-side, operating a 3-drum sander-machine. They were 7½ horsepower A. C. jobs, each turning over 1800 r.p.m.

The manufacturer wanted to reduce the r.p.m. of his motors, so that he could change from belted drive to direct drive. The obvious way to do this would be to put in a slower motor with a larger frame size.

But there were only ⅛ inch clearances between the motor frames!

So, as a test case, he decided to rewire *one* of these motors to run slower. Fiberglas Electrical Insulation was used because its *greater* space factor permitted the additional windings required. This slowed the motor down to 1200 r.p.m., but still allowed it to deliver its full rated horsepower.

That was 15 months ago and not one penny's worth of maintenance has been spent on the test motor, which operates as much as 20 hours a day.

No wonder the manufacturer has decided to rewire the other two sander-machine motors with Fiberglas!

What This Means To You

There are two other variations on this small-motor trick of getting the same H. P. at lower r.p.m. You can get *more* horsepower out of your cotton insulated motors *without* increasing frame size by substituting Fiberglas Insulation, thereby allowing operation at higher temperatures. And you can get *more* horsepower *without* increasing weight.

Or you can get the *same* horsepower you have now by this method . . . in motors that are both smaller *and* lighter.

How To Go About It

Write today for Fiberglas Electrical Engineering Data. Find out why insulation made from this glass in fibrous form has superior electrical insulating properties, how it withstands high temperatures, how it resists acids, oils, and chemicals, how its many other advantages can add up to important maintenance savings for you. Pick the toughest job you have. Put Fiberglas insulation in *that* spot . . . and see for yourself! Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada: FiberglasCanada, Ltd., Oshawa, Ontario.

OWENS-CORNING

FIBERGLAS*

*T. M. Reg. U. S. Pat. Off.

TOLEDO, OHIO

SPECIFY FIBERGLAS ELECTRICAL INSULATION

the condensers and temporary insulation of refrigerant pipes and installation of operating and safety control completed the installation. Installation was started Sunday, 2 p.m., and the system was being charged with refrigerant by Friday, 9:45 p.m. On the following Sunday at 2 a.m. the rink was frozen and first rehearsal was at 2 p.m. At 8:30 that night the carnival started as scheduled.

•

Selling Light Across Bridge Tables

By W. ELIZABETH WHALEY
Home Lighting Director United Electric Light Company, Springfield, Mass.

In home lighting promotion at Springfield we realize the value of carrying on an educational program in addition to our regular home surveys. One activity which we have tried and found successful, both in the way of advertising and domestic load building, is our bridge party promotion. The term "bridge party" undoubtedly, at first glance, seems commonplace as other utilities have tried something of the sort. However, we feel quite safe in saying that our particular activity here has been carried on a little differently from custom in other companies.

We have an auditorium that is devoted entirely to lighting displays. The platform is furnished completely as a model living room, and there is ample space for the newest equipment to be displayed around the room.

Auditorium Provided Free

We offer this auditorium to the various clubs in our territory for bridge parties, and there is no charge made to any club using it. In return, about one-half hour is taken over by us at the beginning of the party to tell a home-lighting story. Through experience, we have found the best results have been obtained by the presentation of humorous, yet informative, skits. All skits used are written by the home-lighting department, and the girls from the department take part. A skit usually takes about twenty minutes. Immediately following this, door prize cards, which have already been given out, are collected and an indirect pin-up lamp, complete with 100-watt bulb, is donated by the company and given to the winner.

These door prize cards, by the way, have a space for the guest's name and address as well as a space to check if they would like a lighting survey or if they have already had one. Both lines are important to us. They give us a definite check on each party. The first, of course, gains prospects for us and the latter tells us why others do not request the survey.

We call on only those customers who sign for a survey. We feel very definitely that just collecting names and addresses in wholesale lots and calling on every one would hinder rather than help us. Any one visiting the building under the latter arrangement would immediately feel that it was that old "high-pressure" method. At each party a good percentage of new contacts have been gained, plus surveys with customers who previously couldn't be convinced by letter or telephone when a house-lighting adviser was in their particular district.

After the presentation of the pin-up lamp, electrically prepared cake and coffee are served without charge by our capable home service department. The remaining time is the club's. This gives a club a wonderful opportunity to enlarge its treasury, as the only cost is for table prizes. This gives us excellent advertising. It has been our experience that "word-of-mouth" publicity has brought us more tangible results than newspaper advertising.

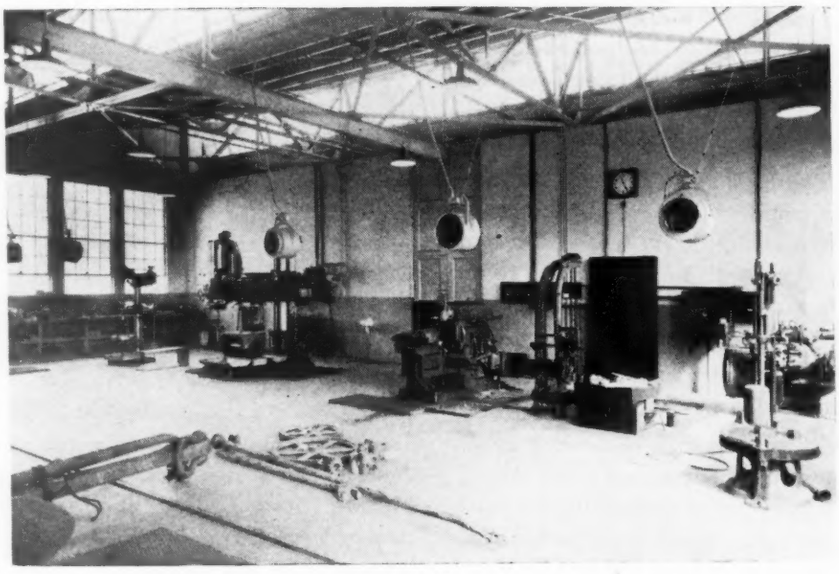
We can serve a maximum of 25 tables in our auditorium, and any club must have at least twelve tables to hold the party. These parties can be held either in the afternoon from 2 to 5 o'clock or in the evening from 8 to 11. During parties a home-lighting girl is always on duty, and is often kept busy answering further questions as the guests are leaving and examining displays in the building. As far as following up prospects is concerned, three girls are usually fully occupied during the season on surveys. Some recent results are shown in the table above.

Total number of bridge parties, October 1939, through May, 1940		91
Average number of tables per party		18
Average number of surveys per party		9
Total increased wattage known installed to date*		
Wattage as result of surveys	45,045	
Wattage from 100 watt pin-up lamps given at each party	9,100	
Total wattage	54,145	
Estimated annual revenue†		$1,624.32

*All check calls and surveys have not been completed.
†Figured on basis we use for all home lighting—750 burning hours at 4-cent rate.

Cost of parties:	
Refreshments (averaged 8 cents per person served)	$524.16
Door prizes, including bulbs	88.27
Total cost	$612.43

Speedy Heating and Quick Installation



Heat for the Los Angeles Harbor Department machine shop is furnished by eleven General Electric forced-convection unit heaters, each 7.5 kw., 240 volts. This electric heating installation makes practically no increase in demand because it is so arranged that the heating circuit is opened when the air compressor is running. Another interesting feature is the double cable suspension, permitting quick installation.

PROOF OF THE POWER OF *Leadership in Action!*

IN 1940 FRIGIDAIRE WILL SELL...

- ✔ More than 600,000 household refrigerators
- ✔ More than 35% of the total industry sales increase over 1939*
- ✔ More than 30% as many electric refrigerators as all others combined*

* Based on United States sales figures released by National Electric Manufacturers' Association for first 10 months and our estimates for remainder of the year.

1940 was a great year for the entire refrigeration industry. Many companies and dealers rose with the tide of events to increased sales. But it remained for Frigidaire selling men to accomplish the outstanding job of this or any other year.

Month after month, Frigidaire dealers and salesmen sold an ever-increasing share of the industry's plus business—securing over 35% of the total increase over 1939, while *other dealers* divided the remainder. Month after month, they turned in great, new sales records. Month after month, they marched to the greatest sales volume in refrigeration history.

The success of the Frigidaire selling organization continues year after year because it is based on a policy of accomplishment—Leadership in Action—that inevitably points the way to leadership in sales.

That's Why, In 1941...

Frigidaire dealers and salesmen will again accomplish outstanding selling achievements. Brilliant, new 1941 Frigidaire products and aggressive selling plans will put them in an even stronger competitive position. Nothing has been overlooked—nothing will be left undone to increase the predominant leadership of Frigidaire dealers.

WATCH THE FAVORITE—
WATCH *Frigidaire*

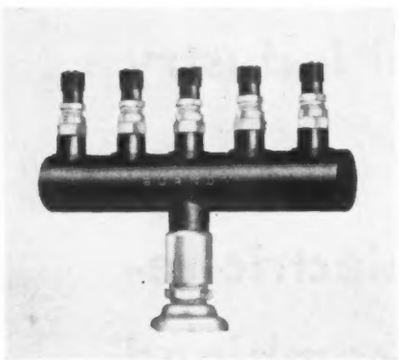
FRIGIDAIRE

FRIGIDAIRE DIVISION, GENERAL MOTORS SALES CORPORATION, DAYTON, OHIO
Frigidaire Electric Appliances • Refrigerators, Ranges and Water Heaters

NEW EQUIPMENT

Connector

With this connector, designed for joining several cables to smooth or threaded stud, the cables are gripped by compression cone clamping elements and the stud is also gripped by a compression cone,



Type "ZMDZ" insulated stud connector; available for joining various sizes and numbers of cables. **Burndy Engineering Co., Inc.**, 459 East 133d St., New York, N. Y.

suitably threaded to screw onto the stud. Insulation of connector is completed by taping exposed metal parts, or company can furnish insulating sleeves which eliminate necessity of taping. Connector is especially suited for stud connections in underground distribution systems, at network protectors, or on secondary terminals of underground transformers.

•

Toboggan

Line maintenance crews operating in the snow country have a new means of transportation in a mechanized toboggan, designed for operation in regions previously accessible only by skiis, snowshoes or dog team, and said to be capable of speeds up to 40 miles an hour over unbroken winter trails. Vehicle employs a framework similar to an ordinary toboggan with a portion of the bed as an endless cleated belt, driven by a 25-hp. air-cooled engine through a three-speed transmission. Belt keeps toboggan from cutting too deeply into snow and also grips snow or ice to furnish necessary traction. Engine is started with foot pedal, clutch and shifting levers are similar to those of an automobile.

"Eliason" motor toboggan; weight, 450 lb.; carrying capacity, depending on snow conditions, 450 to 800 lb. **Four Wheel Drive Auto Co.**, Clintonville, Wis.

•

Smaller Motors

Motor redesign; affects motors in range from ½ to 3 hp. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

Taking advantage of the recent changes in National Electrical Manufacturers Association motor dimension standards, this company has completed a program of motor redesign. Typical of new compactness is new 1½-hp. squirrel-cage induction motor, weighing 25 per cent less and occupying 27 per cent less space than its prototypes of same speed ratings. Features of smaller and lighter motors include redesign of frame shapes, lighter frames, new type seals against dust and dirt.

•

A.C. Welder

Arc-welding transformer, 300 amp. **General Electric Co.**, Schenectady, N. Y.

To its line of arc-welding transformers with built-in power-factor correction, this company has added a 300-amp. size. Like its 500-amp. model previously announced (ELECTRICAL WORLD, October 5, 1940, page 98), this unit provides power-factor correction for other plant load at light loads or no loads, permitting use of smaller line cable, line switches and fuses. Fan-forced ventilation is employed.

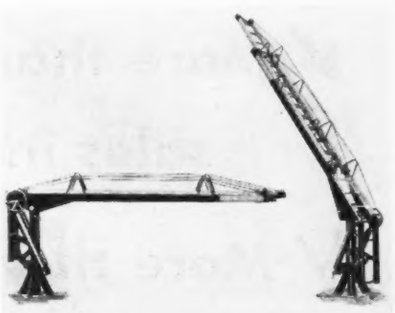
Who Makes What?

"Electrical Buyers Reference," published annually. **Electrical World**, 330 West 42d St., New York, N. Y.

Names, addresses and products of electrical manufacturers are catalogued in this convenient, annual publication for public utility, industrial, engineering and other major electrical buying interests.

Ladder Mount

When installed on a truck body, this new ladder mount may be used for servicing street lamps, tree trimming, repairs and similar work. New features—ladders are balanced by heavy springs; fly ladder

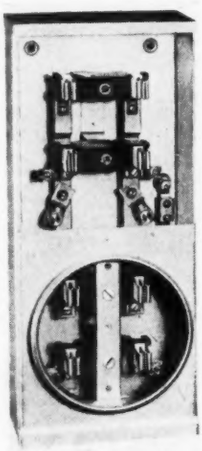


"Keystone" ladder mount. **Electric Service Supplies Co.**, Philadelphia, Pa.

is raised and lowered by hand wheel, has vertical approach ladder and heavier construction for added steadiness and safety; horizontal adjustment throughout 360 deg. and requires only a 21-in. radius of body space for installation. Easier and quicker operation, to speed up work, has been a major objective in its design.

•

Meter Troughs



Standardized socket meter troughs have been added to this line of service equipment. Individual covers for each meter position permit work on any one meter without disturbing the others. Solderless connectors on line side take conductors up to

"No. 3A" outdoor, vertical, two-position trough with one cover removed, provided with disconnects on load side. "No. 3," not shown, differs in not having disconnect means. **Square D Co.**, Detroit, Mich.

WHEN YOU BUY **HUBBARD 4-11-44 WIREHOLDERS**
THEY HAVE BEEN EXPOSED TO A MOST CAREFUL SCRUTINY FOR MANY YEARS—AND FIELD TESTED "BY THE CARLOAD."

HUBBARD AND COMPANY
PITTSBURGH . . . OAKLAND . . . CALIFORNIA . . . CHICAGO

HANG THE LOAD ON HUBBARD HARDWARE"

No. 3/0 wire and on the load side up to No. 4/0. Both types offered are furnished with or without busses, in outdoor or indoor types and in steel or aluminum. Disconnecting on the load side, accomplished by backing out the screw, is done when the meter is not in place, hence no current is broken by screw.

•

Welding Table

"Welding Positioner;" 2,500-lb. capacity. **Ransome Concrete Machinery Co.**, Dunellen, N. J.

With this machine, material weighing up to 2,500 lb. may be positioned for welding. Table top, with T-slots for clamping the material, revolves 360 deg. and tilts 135 deg. beyond the horizontal. A worm and worm wheel arrangement makes the table self-locking when unbalanced loads are handled. On the motor-operated model, equipped with tilting and revolving motors with remote-control push buttons, the variable speed driving unit provides a range from 0 to ½ r.p.m. of the table top.

•

30-cycle Converter

Operating from a 60-cycle input, this electronic converter produces a 30-cycle, half-wave supply for vibrating machinery,

Open view of 30-cycle electronic frequency converter; 1,500-watt size shown, uses 230-volt, 60-cycle input; others sizes from 9 kva. up, for various frequencies, voltages. **Clark Labs.**, Palm Springs, Calif.

including screens, conveyors, coolers, feeders, dryers, packers, saws, hammers, drills, etc. Equally satisfactory operation on any type of load is claimed for the unit.

•

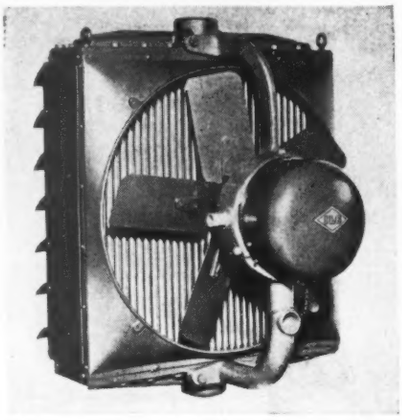
Program Clocks

Synchronous program clocks; type "P 512" operates signal at any five-minute period; type "PD 124" at any one-minute period. **Zenith Electric Co.**, Chicago, Ill.

Time signals of various kinds may be operated with these synchronous program clocks, two models of which have been added to this company's line. Clocks have 24-hour dial and one-hour dial cam. Pointers ride the dials and permit the connected contact arm to fall when preset time is reached. Units are operated by synchronous motors. Contact can be arranged to operate a signal in one ring or coded ring, or for definite period of time.

Unit Heater

New unit heater has been developed for use in textile mills and places where lint and other substances normally adhere to



Textile-type unit heater. **ILG Electric Ventilating Co.**, Chicago, Ill.

fin surfaces and clog up the coils of the standard type of heater. Heater may be suspended from ceiling or wall.

•

Conduit Fittings

Electrical conduit fittings of asbestos-cement composition to fit "Transite" asbestos-cement conduit and thinner-walled "Transite Korduct." **Johns-Manville**, New York, N. Y.

A combination of electrical conduit fittings recently announced can be handled in the same manner as a mitered stovepipe elbow. Consisting of curved segments, deflections couplings and sweeps, the fittings facilitate the by-passing of obstructions not anticipated in the design period and overcome expense and delay of special fittings. Curved segments and deflections couplings fit curves with radii from two to five feet; long radius sweeps, which can be cut into halves, thirds or quarters, are made to a standard radius of 12½ ft.

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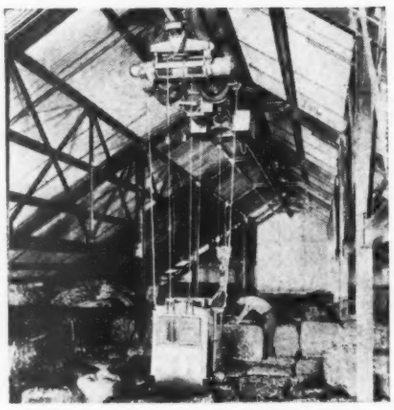
Material Handling

New type of overhead carrier with raise-lower cab is offered by this company in two forms. One form provides for the raising and lowering of cab together, the



"Tramrail" carrier with raise-lower cab; unit shown has vertical travel of 40 ft. for both cab and hook. **The Cleveland Crane & Engineering Co.**, Wickliffe, Ohio.

other for independent raising and lowering of the cab and load. Which type is used depends on service and materials to be handled. With a raise-lower cab unit, one operator can take charge of all operations in moving materials with the electric cab-controlled "Tramrail" system: attaching load to crane hook (or lifting fork), detaching and operation of the carrier unit.

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TECHNICAL LITERATURE

WELDING PROCEDURES—Procedures for producing all types of welds in mild steel, for welding all metals used to any extent industrially and for applying surfacing metal to meet any type of wear-action in service, are given in "The Lincoln Weldirectory." Copies of the 58-page bulletin are available from the Lincoln Electric Co., Cleveland, Ohio.

SEAMLESS TUBING—Specifications covering the manufacture, finish and workmanship, chemical and physical properties, tests and permissible variations in weights and dimensions of seamless tubular products are given in Technical Bulletin 11-C, issued by the Babcock & Wilcox Tube Co., Beaver Falls, Pa. Please write for copies on company letterhead.

FLUORESCENT DESIGN—A new manual, "How to Design Fluorescent Lighting," has been published by the Westinghouse Lamp Division, Bloomfield, N. J. Correct mountings and structural details are given in expanded form to help suggest spacings of units for maximum benefits and efficiency. Importance of room factors are fully explained. Examples and design sketches, as well as a list of general lighting precautions, with remedies and suggestions, and two pages of cost analyses, are included. Copies may be obtained from the advertising and sales promotion department of the Lamp Division at 7 cents a copy.

A.S.T.M. STANDARDS — The 1940-1941 edition of "A.S.T.M. Standards on Electrical Insulating Materials" includes twelve specifications and tests covering flexible varnished tubing, varnished cloth tape (black bias-cut), phenolic laminated sheet, friction and rubber insulating tape, rubber gloves for electrical workers, rubber matting, asbestos yarns and tapes, asbestos roving and cotton tapes for electrical purposes. Procedures are listed for testing electrical insulating oils; three other tests pertain to glass. Also included are proposed specifications for rubber insulating blankets for use around electrical apparatus or circuits. Copies of this 340-page publication can be obtained from A.S.T.M. headquarters, 260 So. Broad St., Philadelphia, Pa., at $2.00 per copy.

WOOD POLES—Comparative costs and life of treated and untreated poles, a discussion of their specification and use and tables showing characteristics and sizes of various species of pole timber are among the subjects covered in a 20-page booklet "Pressure-Creosoted Poles (Form G-15)," published by the Wood Preserving Corporation, Pittsburgh, Pa., a Koppers Company subsidiary. There are included recommended standard specifications for pressure-creosoted Southern pine poles as well as for the creosote used in their treatment.

MANUFACTURING - MARKETS

Square D Expansion Advances; Dividends

Square D Company last week declared a dividend of $1.25 per share of preferred stock, payable January 2 to stockholders of record December 31, and a dividend of $1.50 on the common, payable December 24 to stockholders of record December 17. Counting the dividend just declared, the company has paid a total of $2.80 on common this year, against $1.75 in 1939.

F. W. Magin, president, reported that the industry controller division in Milwaukee is now in a new plant; that the company has increased its facilities at the Kollsman division at Elmhurst, L. I., due to the large volume of instrument orders from the army and navy. He also stated that an addition to the plant occupied by the western division at Los Angeles, Calif., is being erected.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently announced the following assignments to their sales staffs:

B. H. Chamberlain, formerly of the Cutler-Hammer Detroit office, is now with the company's Los Angeles sales staff. The company has just completed its new West Coast factory.

John A. Roebling's Sons Co. has announced the appointment of W. K. Hanna as manager of the Pittsburgh territory, which includes western Pennsylvania and certain areas in Maryland, Virginia, West Virginia and Kentucky. Mr. Hanna has been connected with Roebling's since 1919.

Franklin E. Howell, formerly with Frigidaire, has been appointed wholesale representative of the Eureka Vacuum Cleaner Co. in the St. Louis region. He will be associated with W. H. Bryan, recently appointed manager for the Eureka St. Louis region with headquarters in St. Louis.

Royal Electric Co., Inc., Pawtucket, R. I., has appointed I. W. Silverman, 1516 Fifth Avenue, Pittsburgh, representative for the Pennsylvania territory west of Harrisburg; G. S. Spangler, 618 Colorado Building, Denver, representative in Colorado, Wyoming, Montana, Idaho and Utah.

Frigidaire Division, General Motors Sales Corp., has established its own district office in Albany, N. Y. J. S. Morgan, who has been with Frigidaire in various capacities since 1931, is manager of the office. This office covers a part of New York State, a portion of Massachusetts and New Hampshire and all of Vermont.

•

Vacuum Cleaner Sales Up

Vacuum Cleaner Manufacturers Association reports October industry sales of vacuum cleaners show an increase over the same month of the previous year of 11 per cent, with a total for the month of 152,969 units, as compared with 137,901 units for October of last year. The total for the ten months was 1,428,381 units, against 1,138,152 units for the similar period of 1939, an increase of 25 per cent.

New Orders Up 10%; Shipments 1% Lower

Incoming business of manufacturers of electrical machinery continued to new levels in October, with an advance of 10.5 per cent over September and of 72.5 per cent over October, 1939, according to the *Industry Survey* of the Department of Commerce. Shipments, however, dropped 1.2 per cent during the month, so that unfilled orders rose 19 per cent to match the August rise.

The index of value of electrical machinery orders received in October stood at 252, as compared with 228 in September and 146 in October a year ago. For all durable goods industries this index figure was 239 in October, as compared with 211 in September and 198 in October, 1939.

The index of the value of manufacturers' shipments of electrical machinery dipped to 159, as against 161 in September and 127 in October of last

NEW BUILDING—Prominent officials of General Electric's Schenectady Works, River and West Lynn Works gathered recently to witness the cornerstone laying of the new administration building at the West Lynn factory. N. J. Darling (fourth from right) placed meter No. 20,809,489, the first off the assembly line the day before, in a copper box, along with several publications on meters, in the foundation

At your FINGERTIPS

It's handy! It's compact! It's got just the data you want, where you want it and *when* you want it! The McGraw Central Station Directory is a constantly alive* source of invaluable market and personnel information. Complete listings of 3,606 company units, 10,602 individuals, and 3,811 plants make this reference book indispensable to anyone selling to or working with central stations. Be sure you have a copy, always at your fingertips.

* The 1940 edition incorporated over 10,000 changes—in names, titles, ratings, etc.

McGRAW-HILL PUBLISHING CO., INC.
Catalog and Directory Division
330 West 42nd St., New York, N. Y.

Date.....

Gentlemen: You may mail us.....copies of the 1940 McGRAW CENTRAL STATION DIRECTORY. Deliver to the following address at the rate of $25.00 per copy. (10% discount on 5 or more copies).

(Company) .....

(Address) .....

.....

(Signed) .....
NAME TITLE

year. For all durable goods industries the October, 1940, figure was 170, as against 158 in September and 144 in October, 1939.

Electrical machinery manufacturers' unfilled orders showed a 19 per cent increase in value over September, with a 143 per cent increase over October a year ago. For all durable goods industries there was a 19 per cent increase over September, with a 67 per cent gain over October, 1939.

Index of the value of electrical machinery manufacturers' inventories rose to 122.3 during October, as compared with 116.7 in September and 92.3 in October of last year. For all durable goods industries the October figure was 121.3, as against 118.4 in September and 103.1 in October, 1939.

•

Switchgear Contract Let

Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded a contract to the Severin Electric Co., San Francisco, Calif., at $66,900 for installation of switchgear equipment, consisting of duplex control panels and metal-clad switchgear units; motor-generator set; motor-starting and controlling equipment, and power and control wiring, at new power plant at navy yard, Pearl Harbor, T. H. (Specifications 9963).

•

Doubles Plant Capacity

F. W. Wakefield Brass Co., lighting specialties, has doubled its manufacturing facilities in Vermilion, Ohio. A. F. Wakefield, president, said that the expansion is needed to meet increased demands for fluorescent units. He said that 55 per cent of the company's business this year is in fluorescent units, as against 3 per cent last year. Business in other types has increased about 5 per cent, Mr. Wakefield declared.

•

Moves Office and Plant

Universal Cooler Corp. has moved its offices and plant from Detroit, Mich., to Marion, Ohio.

New York Metal Prices

	Dec. 10, '40 Cents per Pound	Dec. 4, '40 Cents per Pound
Copper, electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.50	5.80
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc, Spot	7.64	7.64
Tin, Straits	50.10	50.20
Aluminum, 99 Per cent	17.00	17.00

* Delivery Connecticut Valley.

INTERNATIONAL makes the Trucks . . . Truck Owners make the REPUTATION

The *reputation* enjoyed by International Trucks has been building steadfastly since the first high-wheeler took to the rough roads of 1907—*33 years ago.*

Today, *International* is the *greatest name in trucks* because Harvester has kept faith with the men who use trucks.

Here's a practical unit for line maintenance—the ¾ to 1-ton International with special body.

All International Trucks are *all-truck* trucks from the ground up—backed always by the world's greatest Company-owned truck service organization!

Year after year truckmen buy *more heavy-duty Internationals than any other make.* They know that Internationals give them *outstanding performance . . . unbeatable economy.*

For all-around *truck values,* join the big family of International owners. The International Dealer or Company-owned Branch near you will be glad to demonstrate the type and size best suited for your business.

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago, Illinois

INTERNATIONAL TRUCKS

Washer-Ironer Week Spurs Shipments

National Ironer-Washer Week, sponsored by the American Washer and Ironer Manufacturers Association, lifted shipments during October to new highs, according to Joseph R. Bohnen, executive secretary-treasurer.

October washer shipments numbered 168,527, an increase of 18 per cent over the 142,830 of the similar month last year and 9.5 per cent above the best previous October, which was in 1936. The October, 1940, total was 13.1 per cent above the September shipments of 149,002 units.

The public, the association data showed, is turning to higher priced washers, the average retail price of $74.86 for the October shipments comparing with $69.50 a year earlier.

The October record lifted washer shipments for the ten months of 1940 to 1,359,405 units, a gain of 8.49 per cent over last year and forecast a twelve-month total of around 1,500,000. This would be the best year for the industry since 1937 when 1,642,000 washers were shipped.

Ironer shipments made an even sharper advance, the October record of 23,282 rising 92.4 per cent above the similar 1939 month and 10.8 per cent above the September, 1940, figure. The ten-month ironer shipment total of 133,350 was 26.7 per cent above the corresponding 1939 period and exceeded the 115,224 units for the twelve months of that year by 15.7 per cent.

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Domestic Copper Sales

Monthly sales of copper by producers for delivery to United States consumers, in short tons, follows:

	1940	1939
January	24,987	15,399
February	147,112	23,361
March	20,305	28,618
April	41,701	59,874
May	83,879	59,026
June	110,453	66,786
July	58,577	183,151
August	67,632	38,299
September	254,277	183,877
October	125,531	68,423
November	85,004	51,630
December	...	28,798

•

Add to Plant Facilities

Announcement has been made by the Despatch Oven Co., Minneapolis, Minn., that it has increased its manufacturing facilities at the Minneapolis plant. Manufacturing floor space has been increased 30 per cent and considerable machinery has been added so that production facilities have been tripled. About 50 per cent of the present production is either directly or indirectly related to the National Defense Program.

Field Reports on Business

Government buying continues on a large scale to speed up industrial activity. Utilities are ordering a variety of equipment. Industrial buying of electrical equipment continues in good volume. Industrialists are looking to a program to bring better labor-management relations to speed national defense.

NEW YORK

Heavy government buying for national defense continues to swell backlog of production. Orders are for a wide variety of electrical equipment, including fuses, electric furnaces, cable, lightning arresters, refrigerators, generators, meter sets, radio and telephone equipment.

Industrial orders continue in good volume as the demand grows for a speed-up in production. Plant expansions are noted in many sections. New Aircraft factories in Buffalo and in New Jersey are under construction.

Some companies are giving consideration to the use of stock bonuses to employees to meet demands for higher wages. This could be done without incurring fixed labor costs and conserve cash for financing plant expansion.

Manufacturers meeting here this week at the Congress of American Industry are suggesting specific ways for creating and maintaining smooth and efficient labor-management relations during the defense program. They are sure to receive government attention as a concrete program.

General Electric has received an order for electric equipment to operate the University of California's new 100,000,000-volt cyclotron. Westinghouse reports unfilled orders of $186,898,589 as of October 31.

NEW ENGLAND

Electrical equipment orders reported in this area last week include an award for a 3,500-kw. turbo-generator unit, placed through a prominent company of consulting engineers, which will be installed in Jamaica, B.W.I., and another unit, 5,000-kw. rating, to be located in a Southern plant. Orders for motors are being received in good volume and include among others six 75-hp. and three 100-hp. from the War Department, to be used in connection with cantonment construction in this district. Machine tool builders continue to dominate the market for small motors, ranging from one to 10 hp.; fractionals are selling well and switch and control apparatus is in good demand. One representative notes several interesting panel board sets amounting to $18,500 and calls attention to a heavy demand for fibre conduit for underground extension of service throughout shipyards in the area. An order has been placed for suspension insulators for a 110-kv. single-circuit line about 10 miles long in eastern New England.

Defense orders released during the past week to manufacturers in this district include $103,080 worth of electric-hydraulic steering gears to the Hyde Windlass Co., Bath, Maine, from the Navy Department; the War Department has awarded a contract for electric cable to Rockbestos Products Corp., New Haven, Conn., totaling $13,504.

The Atlantic Plant, U. S. Electrical Motors, Inc., Milford, Conn., was opened this week. American Bosch Corp., Springfield, Mass., has announced plans for a branch plant to be opened soon at Providence, R. I., and Taft-Pierce Manufacturing Co., Woonsocket, R. I., will expand facilities for fulfilling defense program awards. Christmas lighting supplies are in demand. A group of southern Vermont central stations reports 1940 will be the second best record of refrigerator sales.

PACIFIC COAST

Every kind of electrical material is in brisk demand, either seasonal, such as appliances and holiday lighting, or emergency, such as apparatus, and outside and inside construction. Furthermore, exceptionally mild weather has permitted progress on all REA work and similar extensions of service.

Recent orders of varied interest have included $367,200 Allis-Chalmers transformers and $71,072 Anaconda weatherproof wire for city of Los Angeles; $14,275 for 120 taper tube poles for Alameda; $108,497 for G.E. 15-kv. special service circuit breakers for Bonneville system; $128,750 for enlargement of power plant at San Diego Naval Base; $56,120 for street lighting of McChord Field near Tacoma; a Bremerton, Wash., Navy housing group of 600 dwelling units costing $1,812,300; $230,000 for Diesel-electric cranes at Hunterspoint Dock, San Francisco; $97,084 for G.E. transfer bus equipment, and $25,776 for Westinghouse control equipment for Bonneville Unit A-5.

Allis-Chalmers' bid of $262,620 was low for a steam turbo-electric generator and accessories for Burbank, Calif. The Bremerton Navy Yard, Seattle, will enlarge its electric distribution system to an estimated $525,000. Bonneville is requesting bids on four turbines. Recent Honolulu sales include 1,000 G.E. street-lighting standards, a $13,000 switchboard and eight 50-hp. vertical motors, value $16,000. Pacific Tel. & Tel. Co. has budgeted $46,000,000 during 1941 and $55,000,000 during 1942 for Pacific Coast system additions and betterments, including $7,000,000 for a buried cable between California and Utah.

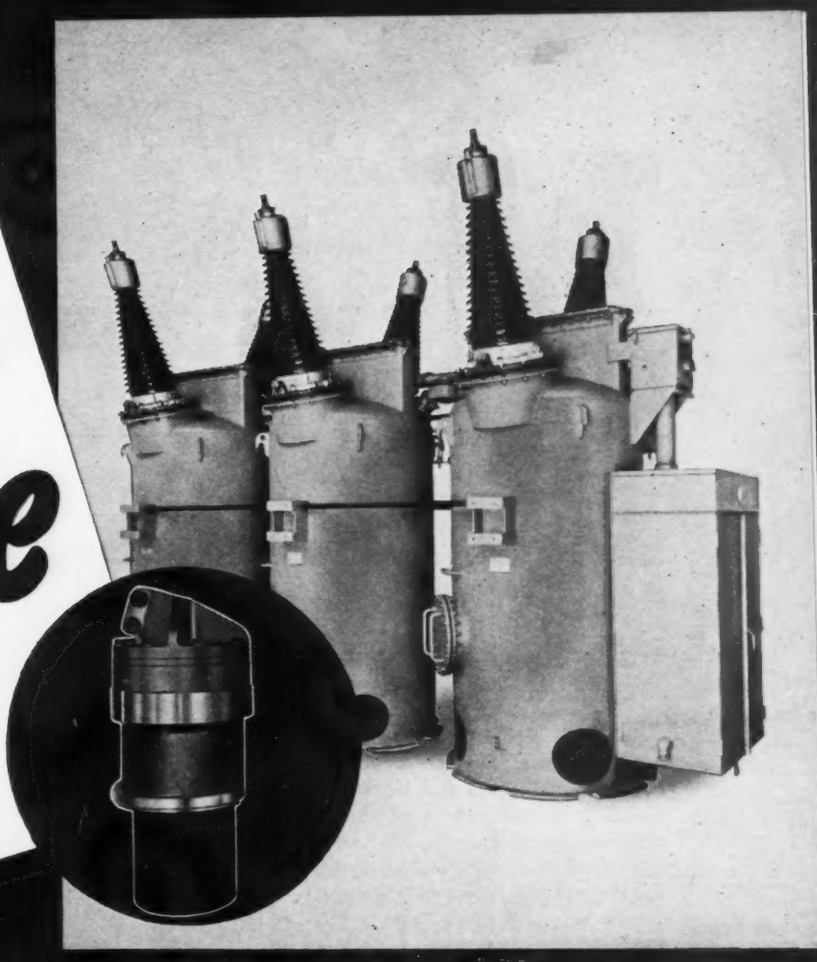
CHICAGO

Reports from a wide variety of manufacturers indicate that this month will mark up new high levels of activity in many fields. Industrial production throughout this area continues to point upward, in many instances establishing new peaks. This heavy demand on manufacturers is bringing an increasing volume of expansion in facilities, resulting in substantial new business for electrical equipment. More than $10,000,000 was authorized for industrial plant additions in Chicago during the past month.

Additional defense contracts placed here last week for electrical equipment include automatic alarms, $78,159; coils, $40,657; generators, $20,238; electromagnets, $10,247; switchboards, $267,729; fixtures, $20,056; testing apparatus, $180,962.

The growing demand for electric power, especially for industrial use, will require additional utility construction next year and plans are being pushed for increased expenditures. Retail trade in this area moved steadily ahead last week, with store sales 10 to 15 per cent over a year ago. The demand for electric appliances and toys is reported to be very good.

AN YOU PAY THE PRICE OF *Excessive* ARCING ?



RUPTORS ARE USED on these Type BZO-60, 1,200 ampere, 138 kv Oil Circuit Breakers with interrupting capacity of 2,500,000 kva, for greater efficiency.

In Installations All Over the Country, "QUICK-QUENCH" Ruptors Are Cutting Oil Carbonization and Contact Deterioration to a Minimum!

When a circuit breaker shows evidence of excessive arcing . . . oil sludging, burning and pitting of arcing contacts . . . when outage time increases and customers notice the interruptions in service . . . that's a situation any operator hates to face!

That's why so many informed users throughout the country have specified Allis-Chalmers Oil Circuit Breakers with Ruptors, for their high voltage systems!

For Ruptors eliminate excessive arcing! They extinguish arcs . . . fast! And . . . their "QUICK-QUENCH" action cuts oil carbonization and contact deterioration! Ruptors are designed and built to handle many more circuit interruptions before inspection is even necessary!

Easy to Service

You get a breaker that's easy to service . . . when it needs it! Ruptors are easy to get at . . . outage time is reduced and service men's time is saved! But Ruptor-equipped breakers don't need constant attention. They'll give you consistent, long range service . . . and you won't have to pamper them!

Get the whole story on "QUICK-QUENCH" action. Let a nearby Allis-Chalmers representative show you what the elimination of excessive arcing can mean to you . . . in increased revenue . . . in savings in time that save money!

980

EDUCE OUTAGE TIME! Available with Allis-Chalmers Ruptor-equipped Oil Circuit Breakers, are high-speed reclosing operators, which restore service well within the new NEMA standard. That means that revenue is sustained . . . costly, time-wasting service trips to substations are reduced . . . and outage time is cut!

SWITCHGEAR DIVISION

ALLIS-CHALMERS

MILWAUKEE·WISCONSIN

METALCLAD SWITCHGEAR • SWITCHBOARDS • OIL CIRCUIT BREAKERS • REGULATORS • MOTOR STARTERS • CUBICLES • SWITCH HOUSES

NEWS ABOUT PEOPLE

Utility Appoints Welsh Superintendent of Power

John R. Welsh, who supervised the construction of the recent addition to the new Shreveport and General Office building in Shreveport of the Southwestern Gas & Electric Co., has been appointed superintendent of power for the company. Mr. Welsh succeeds N. P. Heath, who was made vice-president of the company and general manager of the Shreveport and Caddo divisions.

Following graduation from the University of Illinois in 1924, Mr. Welsh went to work for the L. E. Myers Co. on the construction of Dix Dam near Danville, Ky. He was continuously employed by that company until last June, working on hydro-electric developments, steam generating stations, bridges, buildings, transmission lines, substations, distribution systems and other projects. For five years he resided at Longview, Tex., where he superintended work being done by Southwestern Gas & Electric Co. in that district. During this time he became well acquainted with a large number of people in the utility organization.

He was chief engineer of the L. E. Myers Co. when last June he joined Southwestern Gas & Electric Co. to supervise the construction of the addition to the Shreveport and General Office building.

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▶ EDWARD A. PHOENIX, assistant sales promotion manager in charge of industrial products for Johns-Manville Sales Corp., was honored December 3 at a luncheon at the Hotel Commodore in New York, which marked his completion of 25 years of service with the organization.

▶ E. W. SHARNINGHAUSEN has been appointed treasurer of the American Engineering Co., Philadelphia, Pa. Mr. Sharninghausen became purchasing agent of the company in 1918, the position he held until his recent promotion. He will continue to serve as director of purchases.

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Ingledow Chief Engineer of Canadian Utility

Thomas Ingledow, formerly assistant engineer, electrical department, Montreal Light, Heat & Power Co., has been appointed chief engineer of British Columbia Electric Railway Co., Vancouver, B. C.

Born in Cumberland County, England, Mr. Ingledow attended Glasgow University, but his initial year at that institution was interrupted when he

joined the Royal Flying Corps in 1917. Following the war, he returned to Glasgow University and took postgraduate work at London University.

Coming to Canada, he started as electrical designer with the Ontario Hydro-Electric Power Commission at Toronto. He remained there a year before joining Stone & Webster, Inc., of Boston, Mass. Six months later he returned to Toronto to join the Canadian General Finance Co. In 1925 Mr. Ingledow became identified with the Montreal utility.

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▶ E. A. RIDDELL has been elected president of West Canadian Hydro-Electric Corp., Ltd., Vancouver, B. C., and associated companies, succeeding Col. E. B. Westby.

▶ TONY G. SEAL, director of rates and economic research of Louisiana Power & Light Co. for several years, has been made assistant to George G. Walker, operating sponsor for Ebasco Services, Inc., for the south central group of properties. MALCOLM R. WILLIAMS, formerly connected with the Tennessee Railroad and Public Utilities Commission, will take over the work handled by Mr. Seal.

▶ EARLE N. DOWNING has been appointed executive assistant to John I. Hull, engineer in charge of the Thomas Laboratory at the River Works of the General Electric Co., Lynn, Mass. He joined the company in 1916 as a chemist, and since 1938 has been engineer in charge of the materials testing division of the Laboratory. Mr. Downing succeeds Ross M. Pfalzgraff, resigned.

▶ CHARLES H. FOSTER, formerly of Genoa City, Wis., has been named manager of the Rock County Rural Electric Co-operative in Wisconsin, succeeding PALMER HAMILTON, who is now in Washington as an REA engineer. Mr. Foster was an employee of the Wisconsin Power & Light Co. at Genoa City for twelve years and more recently has been associated with a private contracting firm in that city.

▶ WALTER H. UNDERWOOD, district superintendent at Bridgton for the Central Maine Power Co., has been appointed director of safety, succeeding E. P. NOYES, who will devote his entire

Complete Cable Protection

proved by decades of service in cities having such widely varying ground conditions as . . .

SAVANNAH	ALASKA	CINCINNATI
SEATTLE	PANAMA CANAL	CAMBRIDGE
NEW ORLEANS	DETROIT	MINNEAPOLIS
OMAHA	LOS ANGELES	ALBANY
KANSAS CITY	BUFFALO	ST. PAUL
BOSTON	FORT WORTH	ST. LOUIS
SAN DIEGO		INDIANAPOLIS
SAN ANTONIO		

Bear in mind that Orangeburg Conduit in these cities has been in the ground twenty years or more. Good as this fibre conduit is, today's is even better. Modern equipment, instrument controlled throughout, and laboratory-controlled inspections from raw materials to finished product insure highest quality and utility.

Orangeburg means complete cable protection—protection against ground waters and acids, ground movements, electrolysis, and corrosion. Add to this utility and absence of maintenance a low installation cost and you have in Orangeburg the ideal conduit for your cable systems.

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ORANGEBURG FIBRE CONDUIT

Write for Catalog 46

STANDARD CONDUIT

For installation underground with concrete encasement. Recommended for main distribution, high tension and "downtown" locations.

NOCRETE CONDUIT

For installation underground without concrete encasement. Recommended for extensions, service entrances, parkways and street lighting, signal systems, laterals, etc.

Sales Agent — Distributors

Graybar Electric Co., Inc.

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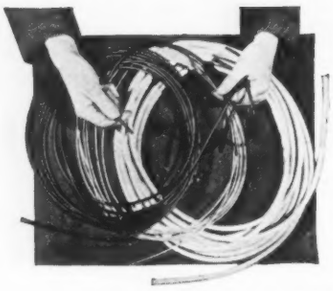
ORANGEBURG

NOCRETE for installation without concrete encasement
STANDARD for installation with concrete encasement

A NEW AND BETTER INSULATION FOR WIRING



XTE-30 XTE-100

Extruded Plastic Tubing in Continuous Lengths for Electrical Insulation in Many Industries

Again Irvington has pioneered in the development and manufacture of an American-made extruded plastic tubing for insulation. High dielectric strength, high mechanical strength, and hitherto unattainable resistance to chemicals, solvents, tearing, abrasion, heat and fire are its outstanding advantages in use. Advantages for the manufacturer include extreme flexibility, inside and outside smoothness, thin walls, resistance to soldering temperatures, availability in continuous lengths, and reduction in assembly costs. Yet this remarkable new product is low in cost.

XTE-100 is used where highest temperatures are encountered, XTE-30 for all other applications.

*Condensed Table of Properties of Irv-o-lite Extruded Tubing for Electrical Insulation

		XTE-30	XTE-100
FLEXIBILITY	Excellent at all temperatures down to	-4° F.	32° F.
TENSILE STRENGTH	of No. 8 tubing, in lbs. per sq. in.	2000	2000
HEAT RESISTANCE	will not crack when bent over A.S.T.M. specification mandrel, after heating at 220° F. for	120 hrs.	more than 240 hrs.
FIRE RESISTANCE	A.S.T.M. specification	won't support combustion	won't support combustion
OIL RESISTANCE	heated in transformer oil at 220° F. for 48 hours	slight & stiffening	slight stiffening only effect
DIELECTRIC STRENGTH	volts per mil up to .022" wet. volts per mil up to .022" dry	350 750	400 750
SOLVENT RESISTANCE	both resistant to following	all petroleum solvents—benzol—toluol—denatured alcohol—acid (30% conc.)—alkalies (30% conc.)	

*For complete data, including tests, sizes, lengths and colors regularly manufactured, uses, samples, and prices, write today for Bulletins on XTE-30 and XTE-100.

Irv-o-lite XTE-30 XTE-100

IRVINGTON VARNISH & INSULATOR CO.

IRVINGTON, NEW JERSEY, U.S.A.

PLANTS AT IRVINGTON, N. J. and HAMILTON, CANADA

Representatives in 20 Principal Cities

time to the continuing property record in the plant department. A new or general safety committee will be headed by G. S. WILLIAMS, vice-president and general manager. ROLAND S. RAND, town representative at Fryeburg, has been appointed district superintendent, succeeding Mr. Underwood. JAMES MERRILL, assistant to Mr. Rand, becomes his successor.

▶ C. T. BAKEMAN, commercial and industrial sales director of the Puget Sound Power & Light Co., Seattle, has been elected president of the newly organized Washington state chapter of the Illuminating Engineering Society.

▶ ARTHUR H. COMPTON of the University of Chicago has been awarded the Hughes Medal by the Royal Society, London, England.

▶ ARTHUR C. NODINE, formerly Philco sales manager for refrigerators and air conditioners in the northeastern states, has been appointed national supervisor of Philco-York air conditioning. Mr. Nodine has been with the Philco Corp. for the past fourteen years. Prior to that he was employed by the Electric Vacuum Cleaner Co. of Cleveland, Ohio, as advertising manager.

▶ L. G. ATKINSON has been appointed manager of a new section of the circuit breaker sales department of the Westinghouse Electric & Manufacturing Co. Formerly in the sales department of switchgear, Mr. Atkinson now has been made head of sales for small Deïon circuit breakers.

▶ JOHN M. SPANGLER, general sales manager of National Carbon Co., Inc., has been made a vice-president of the company. Mr. Spangler joined the company in 1915. He has served as manager of the railroad department, head of the western sales division, with headquarters in Chicago, manager of the eastern division, with offices in New York, and assistant general sales manager. He took over the national sales management five years ago.

▶ BRIG. GEN. CHARLES KELLER, who since 1923 has been associated with the Standard Gas & Electric Co. system in various engineering and executive capacities, has been ordered by the War Department to return to active duty as district engineer of the Chicago District. A graduate of West Point, General Keller has had a distinguished military career. In 1916 he was ordered to Washington for duty under the War Department as assistant to the Chief of Engineers, where he remained until the outbreak of the war, when he became an executive of the committee organized by the Director General of Railroads for the purpose of formulating a plan for solving certain transportation

MAKING HISTORY

. . . the ONLY motors with rotor windings centrifugally cast of COPPER!

Fairbanks-Morse Motors with centrifugally cast rotor windings of *solid copper* are making history. That's natural. Every industry that uses motors has long needed the thermal and electrical characteristics that only motors with one-piece rotor windings of solid copper can provide. Every motor manufacturer has tried for years to build such a rotor. Many made centrifugally cast windings of OTHER metals—but NOT of *copper*.

Then Fairbanks-Morse did it. It took time and money. But the result is worth the cost. Fairbanks-Morse now gives industry a better motor capable of standing up under certain conditions of *severe* service that no other motor could long endure. This motor reduces operating cost. It provides more years of trouble-free operation. It is worth investigating if you use motors. Write Fairbanks, Morse & Co., Dept. 26, 600 So. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

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DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

Designed to meet the
Rugged Requirements
of Your Linemen . . .

A comprehensive background of linemen's actual field experiences with hot line clamps was the basis of design of Southern States' *new* Hot Line Clamps.

They are made of special tin-bronze alloy that provides proper electrical conductivity—great mechanical strength, too. Southern States' new Hot Line Clamps will not distort under ordinary handling and may be used again and again.

Rolled threads at the pressure end of the tightening screw prevent it from backing out the clamp's body or conductor guide.

The conductor guide is full-floating; consequently pressure is evenly distributed over the area of the conductor that is gripped by the clamps. Either hard- or soft-drawn conductor may be clamped without injuring the conductor.

Test specimens proved themselves in our testing department—actual installations are proving themselves in the field.

Ask a Southern States representative to tell you more about these new clamps or . . .

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Southern States
Equipment (SS) Corporation
28 S. 20th St. Birmingham, Ala.

problems brought about by the demands of war. Later he organized the power section of the war industries board, which functioned for the remainder of the war in the effort to secure the most efficient utilization for every purpose of the available amount of electric energy, both steam and water power. In 1918 he was placed under orders to go to France, where he was assigned as Deputy Chief engineer of the A.E.F. In 1919 he returned to the United States, remaining on active duty in the Army until 1923 when he became affiliated with Standard Gas. He has served as a member of the engineering and administrative staffs of Public Utility Engineering & Service Corp. and as president of Empresa de Servicios Publicos de los Estados Mexicanos, S.A. He has also served as a consultant on hydro-electric projects.

▶ THOMAS J. MEEHAN, assistant to the president, Narrangansett Electric Co., Providence, R.I., has been appointed executive secretary to Gov.-elect J. Howard McGrath. Mr. Meehan is a native of Worcester, Mass., and was educated at Holy Cross College and the Harvard Law School. In his earlier career he was an executive in the theatrical field in New England, becoming assistant to President Samuel C. Moore of the Narragansett company in 1935, and in charge of public relations.

▶ SHELDON F. MYERS of Springfield, Mass., has been appointed sales development manager of the Middle Atlantic merchandising division of the Westinghouse Electric & Manufacturing Co. with headquarters in Philadelphia, Pa. Until his transfer Mr. Myers was sales development manager of commercial refrigeration and air conditioning department at the company's plant in East Springfield, Mass. He has been with Westinghouse for 25 years.

▶ LEONID A. UMANSKY has been appointed assistant manager of the industrial engineering department of the General Electric Co. FRANCIS MOHLER has been appointed engineer of the steel mill section, succeeding Mr. Umansky. A native of Russia and a graduate of the Polytechnic Institute of Petrograd, Mr. Umansky entered the Schenectady Works of the General Electric Co. in 1919. After serving in the power and mining engineering department through its transition to the present industrial engineering department, he was transferred to the International General Electric Co. and took up work in Russia. He returned to the industrial engineering department of General Electric in 1933. Mr. Mohler has been connected with General Electric since 1926.

OBITUARY

▶ EVERETT HICKMAN, purchasing agent of the San Joaquin Power division of Pacific Gas & Electric Co., died October 18, in Fresno, of a heart attack. He was 50 years old. Mr. Hickman had been a member of the power company since 1916.

▶ JOSEPH A. BROWNSON, assistant manager of the Salem office of the Portland (Ore.) General Electric Co., died November 15 as the result of a heart attack. Mr. Brownson had been in the employ of the Portland utility for the past 27 years.

▶ FRED L. BRACE, line extension agent for the Portland General Electric Co., Portland, Ore., died suddenly at his home in that city November 15, in his fifty-first year. Mr. Brace had been employed by the Portland utility company for 28 years.

▶ MICHAEL MURPHY, utility president, banker and industrialist, died at his home in Ellicottville, N. Y., on November 22, of a heart attack. He was 80 years of age. Mr. Murphy was president of the Ellicottville Electric Light Co., which he founded in 1906. In addition he was vice-president of the Citizens National Bank of Springville, N. Y., and president of the firm of M. Murphy & Son, which operates lumber mills in New York and Pennsylvania. For more than ten years he was Mayor of Ellicottville.

▶ JAMES R. SHIELDS, electrical engineer of Toronto, Canada, died at his home in that city on November 8. A native of Boston, Mass., he went to Toronto in 1907 and shortly afterward started his own practice, being responsible for the electrical installation of many important Toronto buildings. He was the first provincial inspector for the Hydro-Electric Power Commission of Ontario, under Sir Adam Beck. For twenty years he had been chief electrical engineer to the Toronto Board of Education.

▶ CHARLES F. STUART, assistant to the president of the Northern States Power Co., died at his home in Minneapolis November 29, after an illness of several weeks. Mr. Stuart, former Minneapolis newspaper writer, was born in Grand Haven, Mich., 59 years ago. In 1916 he joined the staff of the Northern States Power Co. Shortly after he was made assistant to Robert F. Pack, vice-president and general manager. When Mr. Pack was elevated to the presidency, in 1931, Mr. Stuart was advanced to the position he held at the time of his death. For many years Mr. Stuart was active in the promotion of rural electrification in northwest territory served by the Northern States Power Co.

Ready for your Toughest Jobs right from the Start!

● There's a reason why the Ford Motor Company has built *and sold* more trucks than any other manufacturer. It's because Ford units give a full measure of service right from the start.

● For example, you get *full value* from your new Ford Truck the very moment you put it to work on your job. Its precision-built engine does *not* have to be "broken in"! By the time the first 100 miles have clicked across the speedometer, you can drive your unit as fast as the law and road and traffic conditions permit. No "coddling" here. Your new Ford Truck pays dividends from the day you take delivery.

● Because of rugged construction, performance and dependability, you can count on Ford operating economy.

● Put a Ford Truck to work for you in 1941! Ask your dealer for a *free* "on-the-job" test that will prove what a Ford unit can do for you under *your own* operating conditions.

FORD V-8 TRUCKS and Commercial Cars

FORD MOTOR COMPANY • BUILDERS OF FORD V-8 AND MERCURY CARS, FORD TRUCKS, COMMERCIAL CARS, STATION WAGONS AND TRANSIT BUSES

Ford

The MOST COMPLETE LINE OF Terminal Lugs

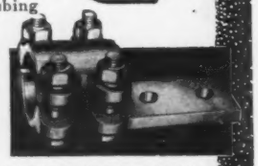
THOUSANDS of patterns — you can find the exact lug you want.

Penn-Union E-Z Lugs take a wide range of conductor sizes. Only 5 sizes of lugs for wire and cable from No. 6 to 1,000,000 CM. Self-locking; positive. Re-used over and over.

QUICK, SIMPLE INSTALLATION with the popular Penn - Union VI-TITE lug. Vise-like action gives a sure grip. Made in a wide range of sizes.

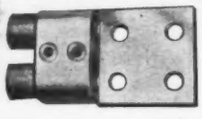
Fully approved *Soldering Lugs*, pressed from pure seamless copper tubing, and annealed. Also cast Heavy-Duty Soldering Terminals—and shrink fit lugs for copper tubing.

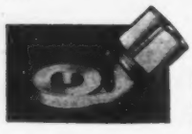
CLAMP TYPE terminals in widest variety. Straight or angle, for cable or tubing, with any desired contact tongue.



SCREW TYPE Solderless, easy to use and universally popular, especially in the small sizes. For both solid and stranded wires.

MULTIPLE CABLE terminals. We can furnish any style lug for two or more conductors.





SLEEVE TYPE terminals, with split contact sleeves, preferred by many large users. Made in many types.

See the Penn-Union Catalog for any kind of Terminal Lug — carefully made, thoroughly tested, *Dependable.*

Also the most complete line of Cable Taps, Service Connectors, Ground Clamps, Two-Ways, Tees, etc.

Sold by Leading Jobbers

Write for Catalog

PENN-UNION ELECTRIC CORPORATION

ERIE, PA.

PENN-UNION

Conductor Fittings

St. Lawrence Inconsistencies

[*Continued from page 74*]

000 more horsepower from Niagara without marring the beauty of the falls. Or he can recommend inexpensive steam plants which can be built for a few millions in a year."

"Plants now in construction on the Ottawa River," the *Times* says, "to generate 400,000 hp. will be ready by that year (1942). About 300,000 hp. at peak load can be obtained from De Cew Falls on the Welland Canal, and Quebec can build plants and supply all the power that eastern Canada needs."

Curiously enough on this same day, December 6, Ernest K. Lindley, the outstanding supporter of Roosevelt policies among the columnists, emphasizes the time element in the war situation. "Five hundred bombing planes delivered before February 1 may be more valuable," he wrote, "than 2,000 delivered in the last two months of 1941."

And here is the President all churned up about the national defense angle of the St. Lawrence Seaway, which Mr. Olds admits will not produce power before 1945, even if construction is started speedily!

•

Recent Rate Changes

NORTH LITTLE ROCK, ARK., electric department customers will be granted reductions of rates amounting to approximately 17 per cent, effective December 15. Mayor Neely stated that increased consumption of electric energy was responsible for the reduction.

ILLINOIS COMMERCE COMMISSION has announced that rate changes effective in the state during the month of October resulted in an estimated reduction of $71,636 in annual operating revenues. Of this sum, $70,820 represented electric rate cuts.

FLORIDA POWER CORP., St. Petersburg, has announced a reduction in commercial lighting rates involving an annual saving to local business firms of more than $85,000. The reduction became effective with meter readings taken on and after December 1. Approximately 90 per cent of this saving will benefit commercial lighting customers using service on a year-round basis. The new rate for this class of service is as follows: $1 for the first 12 kw.-hr., 7 cents per kilowatt-hour for the next 88 kw.-hr., 6 cents per kilowatt-hour for the next 400 kw.-hr., 5 cents per kilowatt-hour for the next 2,500 kw.-hr., 3 cents per kilowatt-hour for the next 7,000 kw.-hr., 2 cents per kilowatt-hour for all excess; minimum charge, $1.

MISSOURI GENERAL UTILITIES CO. has filed with the state Public Service Commission a schedule of reduced rates for electricity for 45 southeast Missouri towns and cities. The new rates are expected to result in a saving of $6,681 a year.

NEVER STAB a POLE in the BACK

● Deep stab holes have shortened the life of many costly poles by providing a place where moisture accumulates and rot starts.

Use the new MULTIPOINT CANTHOOK. Its six ¼" points hold more securely than a single long point—yet leave no deep, dangerous holes—in fact, they do not penetrate through the creosote treatment. Here is an easy and inexpensive way to eliminate injurious holes. Further, the new Multipoint Cant Hook gives greatly increased efficiency in pole handling—it grips more securely—spreads the strain over larger area—and more than that, it's self-releasing.

Safer and more efficient to use—will not injure costly poles. Made by The American Fork & Hoe Co., Cleveland, O.

STURDETOOLS *a* **TRUE TEMPER PRODUCT**

STURDETOOLS
MULTIPOINT CANT HOOK
6 points ¼"x½" in size grip the pole securely but leave no deep hole to encourage rot and decay.
Furnished in small, medium and large sizes for handling poles up to 22" in diameter. Prices and complete description on request.

Distributed by

JOSLYN MFG. AND SUPPLY CO.

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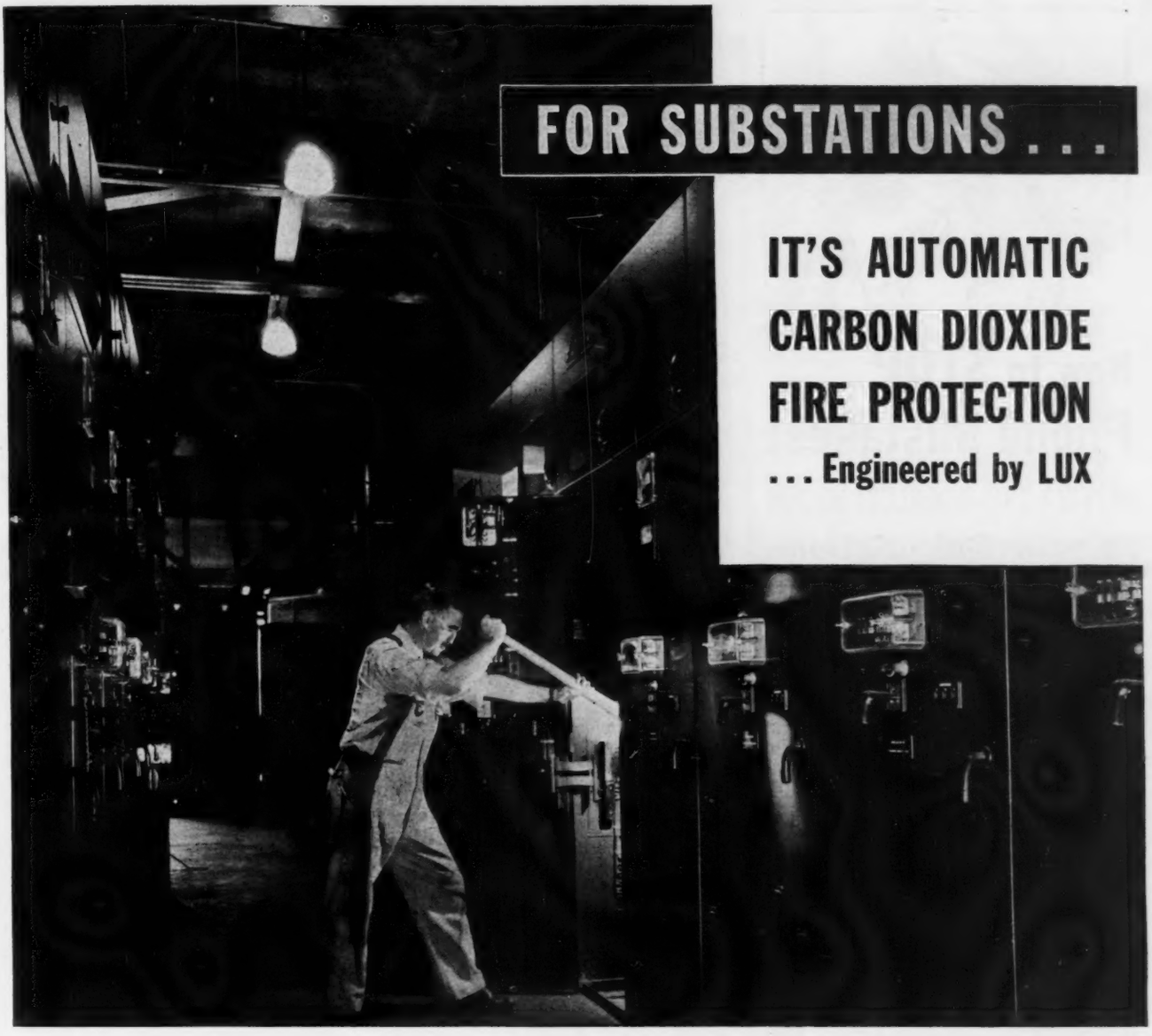
Branches and Warehouses with Complete Stocks in Principal Cities of the United States



FOR SUBSTATIONS . . .

IT'S AUTOMATIC CARBON DIOXIDE FIRE PROTECTION

. . . Engineered by LUX

THERE'S a double fire hazard in substations. Coupled with the danger of insulation fires, you have the problem of oil blazes.

Fight these blazes with built-in automatic carbon dioxide extinguishing. Kill fire in a fast blast of carbon dioxide snow-and-gas with a LUX System. Clean, dry, harmless, LUX smothers blazes without damage to equipment, with maximum speed, with minimum "outage".

FLEXIBILITY

LUX substation installations permit great flexibility. As few as five 50-lb. LUX cylinders, as many as a hundred and fifty can be used in one station. In a small room you can automatically pick off proper number of cylinders for that space, permitting balance to be held in reserve. To simplify storage you may group LUX cylinders irregularly to fit layout.

Automatic LUX control means prompt detection, fast extinguishment. Especially suited for unattended stations, since no continuous maintenance is required.

You'll find an interesting discussion of these problems in "LUX Built-In Systems", a free brochure. Write today for your copy.

LUX
SNUFFS OUT FIRE

Walter Kidde & Company

INCORPORATED

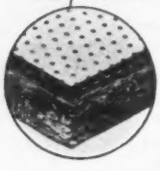
1228 West St. **Bloomfield, N. J.**

How to STOP Phone Mistakes!

INSTALL THIS DOORLESS BOOTH *in your Sub-stations and Turbine Rooms*

The noise of turbines, generators, and other electrical equipment cannot interfere with your telephone service when your station telephones are installed in Burgess Acousti-Booths.

These doorless booths are lined with an acoustic lining that absorbs noise like a blotter. A "zone of quiet" is produced within the booth that makes telephoning easy in the noisiest stations.



Never Stuffy

The open construction assures free circulation of air without a booth fan. The absence of doors permits quick access to the telephone, even when carrying charts, papers, or other material.

Made of steel throughout, these booths fit into any station interior. Hundreds of Burgess Acousti-Booths are in daily industrial service. Frequent reorders are received from satisfied users.

Easy to use . . . easy to clean . . . easy to install. Don't risk telephone errors any longer. Write, today, for full information.

Mail Coupon for Free Booklet

Burgess Battery Company, Acoustic Division
Dept. EW, 500 W. Huron St., Chicago

Please send Free booklet describing Burgess Doorless Acousti-Booth and how it makes telephoning easy in noisy places.

*Name*_____

*Company*_____

*Address*_____

BURGESS ACOUSTI-BOOTH
Manufactured under Burgess Patents

Sales Opportunities

WINSTON-SALEM, N. C.—Duke Power Co., Charlotte, N. C., plans new double-circuit, steel tower transmission line from Buck steam-electric generating station on Yadkin River, near Spencer, N. C., to Winston-Salem, close to 40 miles. Work will be carried out early next year.

CANTON, OHIO—Timken Roller Bearing Co., manufacturer of steel bearings, tubing, etc., plans installation of motors and controls, duct lines, switchgear, industrial lighting facilities, electric hoists, conveyors and other equipment in group of new additions to plants at Canton, Gambrinus and Mount Vernon, Ohio, totaling close to 185,000 sq.ft. of floor space, in all. Work will be carried out at early date. Cost estimated close $2,750,000.

WASHINGTON, D. C.—Bureau of Yards and Docks, Navy Department, Washington, receives bids (no closing date stated) for 300-kw. electric alternator, gasoline engine-operated, with switchgear, panelboards and accessory equipment, for navy yard, Mare Island, Calif. (Specifications 10070).

WEST POINT, IOWA—Town Council receives bids until December 30 for extensions and improvements in municipal electrical distribution system, including (1) reconstruction of 11,000-volt transmission line and power substation; (2) reconstruction and extensions in distribution and street-lighting systems; (3) new outdoor-type meters and armored services; (4) feeder regulators and control equipment; (5) converting motors and other equipment of consumers for 60-cycle service; and (6) for addition to building for new control station. G. L. Van Fleet Company, 1211 West Nineteenth Street, Cedar Rapids, Iowa, is consulting engineer.

HARRISON, N. J.—Crucible Steel Co. of America, Inc., 405 Lexington Avenue, New York, N. Y., plans installation of heavy-duty motors and controls, transformers and accessories, electric furnace unit and auxiliary apparatus, switchgear, industrial lighting facilities, electric hoists, conveyors and other equipment in new additions to plant on South Fourth Street, Harrison. Project will proceed at early date and is scheduled for completion in about six months. Cost reported over $1,000,000.

MARYVILLE, TENN.—Aluminum Co. of America, Inc., Gulf Building, Pittsburgh, Pa., plans installation of motors and controls, regulators, duct lines, switchgear, exterior lighting system, interior lighting facilities, motor-generator sets, electric hoists, conveyors and other equipment in new aluminum sheet mill in vicinity of McGhee-Tyson airport, Maryville, where tract of about 20 acres of land has been acquired. A power substation will be built connecting with central station lines for power service at mill, which will consist of several large production units. Project is estimated to require from 20 to 24 months for completion. Cost reported in excess of $10,000,000.

TROY, OHIO—City Council plans improvements in municipal power plant, including installation of new switchgear, capacitors and other equipment. Also will build new power substation on site now being selected, and will make extensions and improvements in distributing lines in different areas. It is proposed to install a submarine cable line under Miami River, replacing overhead transmission line. Entire project is estimated to cost close to $100,000. Surveys are being made by Froehlich & Emery Engineering Co., Second National Bank Building, Toledo, Ohio, consulting engineer.

SUPERIOR, WIS.—Superior Water, Light & Power Co. plans new automatic power substation on site at Ogden Avenue and 28th Street. Work will be carried out by company forces and is scheduled to begin at early date.

SAN DIEGO, CALIF.—Consolidated Aircraft Corp., Lindbergh Field, plans installation of motors and controls, duct lines, switchgear, exterior night lighting system, interior industrial lighting facilities, interior communication system, transformers and accessories, electric hoists, conveyors and other equipment in new plant in vicinity of present works, to be used for production of large bomber airplanes and flying boats. It will comprise a series of eight one and multi-story units, totaling about 1,550,000 sq.ft. of floor space and is scheduled for completion next summer. Cost reported about $6,500,000.

SIDNEY, IOWA—Iowa-Nebraska Light & Power Co., Lincoln, Neb., plans extensions and improvements in power station at Sidney, including installation of additional equipment. Proposed to begin work soon. No estimate of cost announced.

HARRISBURG, ILL.—United States Engineer Office, Federal Building, Louisville, Ky., receives bids until January 3 for two electric-operated pumping plants at Harrisburg (Saline County), including construction of electric transmission line for power service.

•

Adds 408 Ranges to Lines

Reduced rates are credited with an addition of 408 electric ranges to Seattle City power lines during the month of September, according to an announcement made by E. R. Hoffman, superintendent of City Light. This brings the total number of ranges in service in Seattle to 40,037, Mr. Hoffman said. Revenue for the twelve months ended September 30 amounted to $6,298,434, the largest volume for such a period in the department's history and $194,291 more than the corresponding period one year ago.

•

Probe Cost $38,125

Investigation of the physical assets of the British Columbia Electric Railway Co., started last year by the Public Utilities Commission, had cost the company $38,125 up to March 31 of this year, the public accounts tabled in the B.C. Legislature showed recently. Under the Public Utilities Act costs of an investigation made by the board are charged to the company, which is then entitled to take them into account in fixing rates. The inquiry is still in progress.

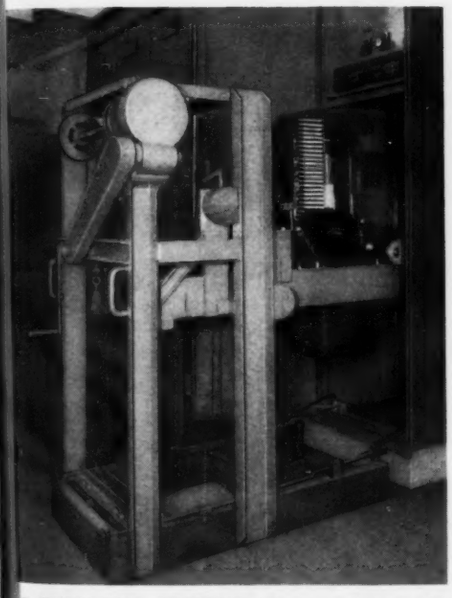
6 *Little* DETAILS
that make R-S Switchgear Better

Roller-Smith has been building good metal-clad switchgear for years. The number of repeat orders that have been received from discriminating power companies and industrial concerns attest to that.

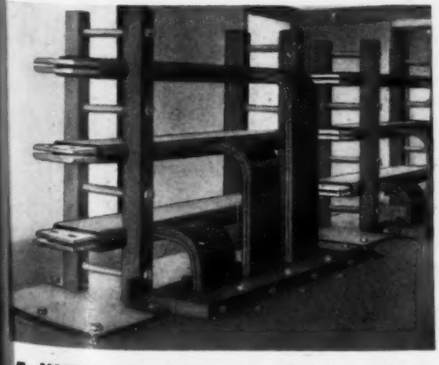
But we are always striving to make our switchgear even better. Since every job is tailor-made . . . designed and built to meet the conditions of one particular application . . . improvements constantly are being made.

The six details shown below are representative of the attention paid to the small things in Roller-Smith Master Metal-Clad Switchgear. Catalog 8-a will show you many more.

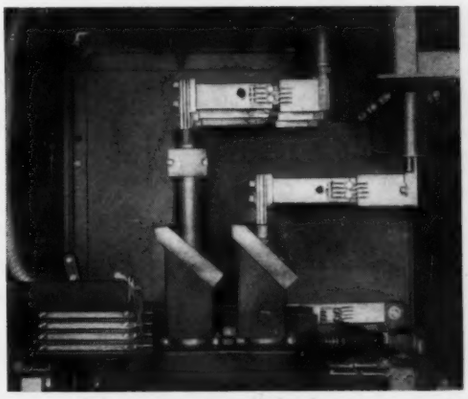
Before you buy any type of switchgear why not investigate Roller-Smith. It costs nothing, yet you may find big dividends in a better job for your money.



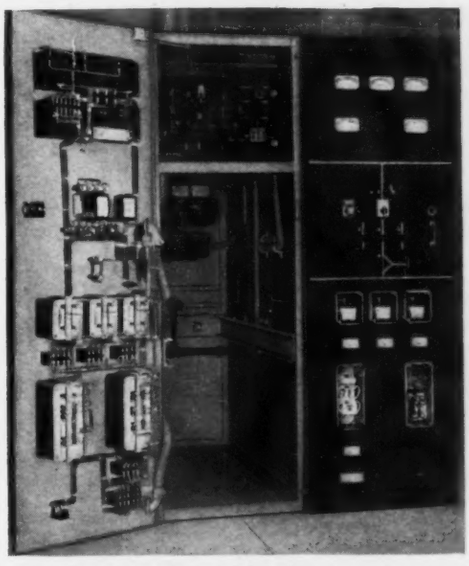
1 HORIZONTAL DRAWOUT—Each stationary element has a machined channel track for horizontal removal of the breaker. This accurately aligns the removable element when inserted. No lifting is required . . . the breaker is inserted by a simple horizontal roller action.



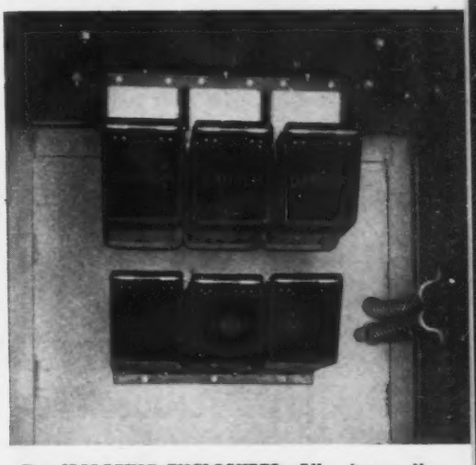
4 MOLDED INSULATED BUS—Main bus and the tap connection to primary disconnecting device are specially molded in a bakelite sheath. The insulation is continuous over the tap. Short lengths of bus with flexible leaf copper between sections, allow for expansion.



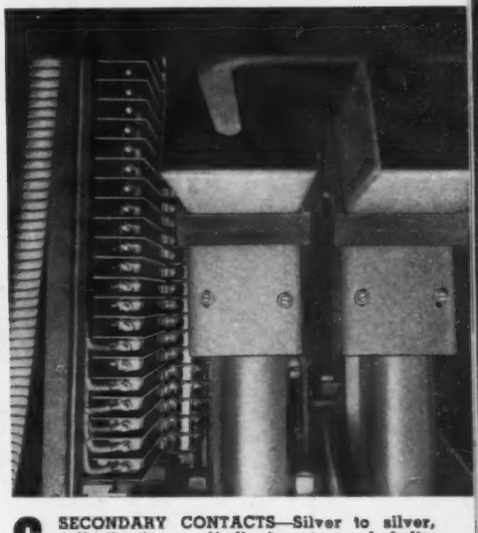
2 PRIMARY DISCONNECTS—The flexible parts of the primary disconnecting devices are on the removable element to assure easy inspection. The high pressure on the self-aligning, silver surfaced contacts is maintained by compression springs. Even if the spring should break pressure would be maintained.



5 AMPLE PANEL SPACE—There is ample room on the hinged front panels for mounting all necessary relays and instrument. Flush or surface mounted instruments, relays and devices can be furnished. Potential transformers and current limiting resistors usually are mounted in a separate compartment.



3 ISOLATING ENCLOSURES—All primary disconnecting contacts are enclosed in individual bakelite isolating enclosures of high dielectric strength. They are equipped with an automatic device for completely enclosing all live parts when breaker is withdrawn.



6 SECONDARY CONTACTS—Silver to silver, full floating, self-aligning type, bakelite mounted. Unit construction allows any number of segments to be built up. Connections from the stationary element to the removable element are automatically established in both "operating" and "test" positions, eliminating the necessity of plugging in test jumpers.

Electrical Measuring and Protective Apparatus

ROLLER-SMITH COMPANY BETHLEHEM, PENNA.

Switchboards • Metal Enclosed Switchgear • Electrical Instruments
Indoor and Outdoor Oil Circuit Breakers • Air Circuit Breakers

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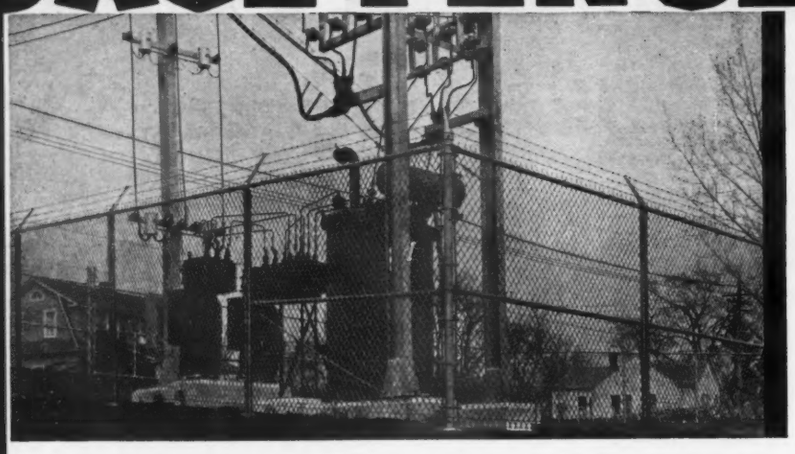

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● For years fence posts have been merely adaptations of structural shapes used also for other purposes. Now Page has developed a post especially for chain link fence—the winged channel post providing greater strength and longer life. Properly erected on these posts, your Page Fence is up to stay. Each of the 97 factory-trained Page distributors is a local, thoroughly responsible business man from whom you get expert advice and workmanship. Write to PAGE FENCE ASSOCIATION, Bridgeport, Conn., Atlanta, Chicago, New York, Pittsburgh or San Francisco for book, "Fence Facts."

A PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC.

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RECLAIM Your Short Lengths of WIRE—

Splice Them the Easy, Sure Way—with Nicopress Sleeves

Note how easily Nicopress Splices are made.

At a very low cost you can make those "short lengths" of wire available for service by splicing them with Nicopress Sleeves.

The completed splices are small and neat, not much greater in diameter than that of the wire—they'll pull easily over cross arms as sleeves are bevelled at both ends—they are strong and tight, equalling or exceeding the rated breaking strength of the conductors.

You'll be pleased with the real savings secured by reclaiming your wire by the Nicopress Method.

The Wire Coils Easily When Spliced the Nicopress Way

Nicopress Sleeve

Completed Nicopress Splice

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Canadian Mfr.—N. Slater Co., Ltd., Hamilton, Ont.

Export Distributor—International Standard Electric Corp., New York, N. Y.

Allot Rural Funds; New Contracts Let

Recent allotments made by the Rural Electrification Administration provide for the establishment of new co-operatives and the enlargement of co-operative power systems. Among the allotments are the following:

IDAHO—Prairie Power Co-operative, Inc., Fairfield, W. W. Leek, president, $87,000 to build 115 miles of line, 178 members in Camas County.

MINNESOTA—P.I.C.K. Co-operative Electric Assn., Braham, Beauford Johnson, supt., $138,000 to build 157 miles of line, 348 members in Mille Lacs, Benton, Isanti, Chisago, Pine and Morrison counties. South Central Electric Assn., St. James, Edward C. Meier, supt., $146,000 to build 185 miles of line, 364 members in Watonwan, Cottonwood, Martin and Blue Earth counties.

MISSISSIPPI—Twin County Electric Power Assn., Hollandale, E. B. Neely, supt., $115,000 to build 159 miles of line, 672 members in Washington, Humphreys, Sharkey, Issaquena and Sunflower counties.

OHIO—Belmont Electric Co-operative, Inc., St. Clairsville, Harry McAllister, supt., $130,000 to build 129 miles of line, 370 members in Belmont, Harrison, Noble and Johnson counties.

OKLAHOMA—Southeastern Electric Co-op., Durant, Rosco D. McCalman, supt., $141,000 to build 151 miles of line, 422 members in Bryan, Johnston and Atoka counties.

SOUTH CAROLINA—Horry Electric Co-op., Inc., Conway, P. S. Page, $233,000 to build 252 miles of line, 1,140 members in Horry County. Blue Ridge Electric Co-operative, Inc., Pickens, F. O. Durham, president, $417,000 to build 451 miles of line, 1,769 members in Oconee, Pickens, Anderson and Greenville counties.

TENNESSEE—Sequatchie Electric Membership Co-op., South Pittsburg, $160,000 to build 154 miles of line, 862 members in Grundy, Sequatchie, Marion and Bledsoe counties. City of LaFollette, $175,000 to build 140 miles of line, 930 members in Campbell and Claiborne counties.

TEXAS—Pailey County Electric Co-operative Assn., Muleshoe, Cecil W. McLaury, supt., $128,000 to build 193 miles of line, 390 members in Bailey, Lamb, Parmer, Castro and Cochran counties.

UTAH—Garkane Power Assn., Inc., Hatch, Robert A. Middleton, supt., $22,000 for additional generating equipment.

VIRGINIA—Shenandoah Valley Electric Co-operative, Dayton, L. E. Long, supt., $60,000 for additional generating equipment. Central Virginia Electric Co-operative, Lovingston, James D. Cooke, manager, $115,000 to build 105 miles of line, 312 members in Albemarle, Buckingham, Cumberland, Goochland, Nelson, Appomattox and Fluvanna counties.

WEST VIRGINIA—Harrison Rural Electrification Assn., Clarksburg, Roy E. Cork, supt., $85,000 to build 96 miles of line, 405 members in Harrison, Barbour, Lewis, Upshur and Doddridge counties.

WISCONSIN—Richland Co-operative Electric Assn., Richland Center, Herbert H. Stofen, supt., $33,000 to build 20 miles of line, 54 members in Richland and Crawford counties.

Contracts approved late in October and early November included:

NORTH CAROLINA—Lumbee River Electric Membership Corp., Raeford, D. J. Dalton, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, con-

Low cost insulating oil purification increases sub-station dependability

Speed and economy of operation combine with dependability of results to make the De Laval Insulating Oil Purifier the choice of leading power systems in meeting their oil maintenance problems.

The De Laval Purifier restores the required high dielectric value of oil in a single pass, eliminating re-runs; continuously discharges water, permitting long, continuous operation at uniformly high efficiency with a minimum of attention. As a result the yearly cost of dehydrating oil in transformers and circuit breakers can be much reduced.

Speedier, less costly oil purification, which is at the same time more positive, leads naturally to improving the average dielectric value of oil in all units, thus contributing directly to dependable sub-station performance.

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Dependable Sub-Station PERFORMANCE

DE LAVAL INSULATING OIL PURIFIERS

Economically Protect Oil-Insulated Equipment

modernize
YOUR
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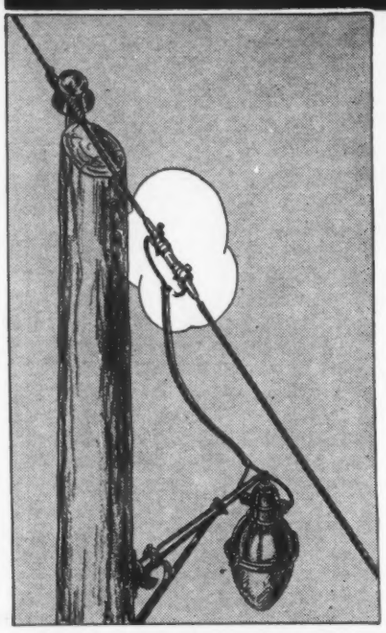

RELIABLE INSULATED STRAIGHTLINE SPLICE

A neat and convenient means of breaking the line for series street lighting, for secondary banking, for sectionalizing. Will develop full line wire strength and may be installed on existing construction without splicing in an extra length of wire.

Insulating section is a tough and strong plastic with high dielectric strength which will not carbonize nor absorb moisture.

Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
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tract to Day & Zimmermann, Inc., Philadelphia, Pa., 484 miles of line, 1,211 members; bid, $284,863.

OHIO — Carroll Electric Co-operative, Inc., Carrollton, Harry Merrick, supt., and Gibbs & Hill, Inc., New York, engineer, contract to Miller-Baxter Co., Inc., Indianapolis, 303 miles of line, 890 members; bid, $210,353.

OKLAHOMA—Cotton Electric Co-operative, Walters, C. W. Cox, supt., and Midwestern Engineering & Construction Co., Drew Bldg., Tulsa, engineer, contract to the Elkhorn Construction Co., Norfolk, Neb., 231 miles of line, 411 members; bid, $125,172.

PENNSYLVANIA—Somerset Rural Electric Co-operative, Inc., Somerset, Harvey S. Jennings, supt., and Putnam and Woolpert, Dayton, Ohio., engineer, contract to Kingsbury-Samuel Electric Co., Baltimore, Md., 208 miles of line, 568 members; bid, $157,139.

SOUTH CAROLINA—Coastal Electric Co-operative, Inc., Walterboro, J. B. McCrary Engineering Corp., Atlanta, engineer, and Jesse D. Padgett, supt., contract to R. H. Bouligny, Inc., Charlotte, N. C., 245 miles of line, 490 members; bid, $125,052.

TENNESSEE—Carroll County Board of Public Utilities, Huntingdon, George A. Myrick, supt., and Pat M. Sullivan, Gallatin, engineer, contract to Stuart C. Irby & Co., Jackson, Miss., 115 miles of line, 570 members; bid, $83,165.

TEXAS — Nueces Electric Co-operative, Inc., Robstown, Marvin S. Baker, supt., and Texas Engineering Co., Austin, Tex., engineer, contract to J. E. Morgan and Sons, Waco, Tex., 239 miles of line, 437 members; bid, $108,008.

UTAH—Moon Lake Electric Assn., Inc., Mt. Emmons, E. D. Conklin, supt., and Walter W. Flora, Cheyenne, Wyo., engineer, contract to H. A. Risk Pipe and Construction Co., Nebraska City, Neb., 147 miles of line, 406 members; bid, $91,611.

VERMONT—Vermont Electric Co-operative, Eden Mills, Harry D. Bowman, supt., and Walter N. Cook, Johnson, engineer, contract to Donovan Contracting Co., St. Paul, Minn., 187 miles of line, 315 members; bid, $120,927.

VIRGINIA—Powell Valley Electric Co-operative, Jonesville, D. L. McNeil, supt., and B. O. Vannort, Charlotte, N. C., engineer, contract to the Codell Construction Co., Inc., Winchester, Ky., 201 miles of line, 700 members; bid, $162,868.

WASHINGTON—Columbia County Rural Electric Assn., Inc., Dayton, Oakley A. Kendall, supt., and Walter W. Flora, Cheyenne, Wyo., engineer, contract to City Electric Co., Nampa, Idaho, building 205 miles of line, 220 members; bid, $120,364.

WISCONSIN — Polk-Burnett Electric Co-operative, Centuria, Dorris D. McChesney, supt., and Wisconsin Development Authority, Madison, engineer, contract to L. A. Bumgardner & Co., St. Paul, Minn., 197 miles of line, 450 members; bid, $119,334.

WYOMING—Big Horn Rural Electric Co., Basin, Maurice N. Roush, supt., and H. S. Nixon, Omaha Grain Exchange Building, Omaha, engineer, contract to Big Horn Construction Co., Sheridan, Wyo., 141 miles of line, 259 members; bid, $93,346.

MISSOURI—Farmers' Electric Co-operative, Chillicothe, Mo., Ernest Wood, supt., and Frank Horton & Co., Lamar, Mo., engineer, contract to Richards and Millinix, Inc., Oklahoma City, 263 miles of line, 321 members; bid, $138,689.

NEW HAMPSHIRE—New Hampshire Electric Co-operative, Inc., Plymouth, Leon M. Huntress, supt., and J. R. Worcester & Co., Boston, Mass., engineer, contract to Miller-Baxter Co., Inc., Indianapolis, Ind., 188 miles of line, 296 members; bid, $136,736.

Just off the press!

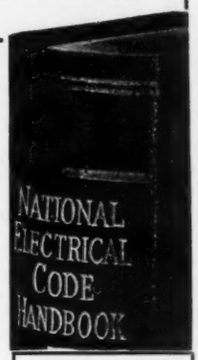
THE NEW NATIONAL ELECTRICAL CODE HANDBOOK

COVERING THE NEW 1940 CODE

By Arthur L. Abbott

FULLY REVISED FIFTH EDITION

585 pages, 5 x 7½, Illustrated, $3.00



Here is the electrical contractor's job book almost completely re-written in accordance with the new 1940 Code requirements, planned to enable electricians to understand the new rulings of the National Electrical Code and to do work in accordance with the Code.

Simplifies the Code for quick, easy application

It restates rules in simple language, plus explanations, practical directions, and diagrams, showing what the rules mean and how to apply them. *It groups rules in special arrangements, making it easy to find ALL rules applying to any given job.*

IMPORTANT NOTE

The new 1940 Code contains more changes than any previous Code, and the new ABBOTT covers fully every item of this new Code.

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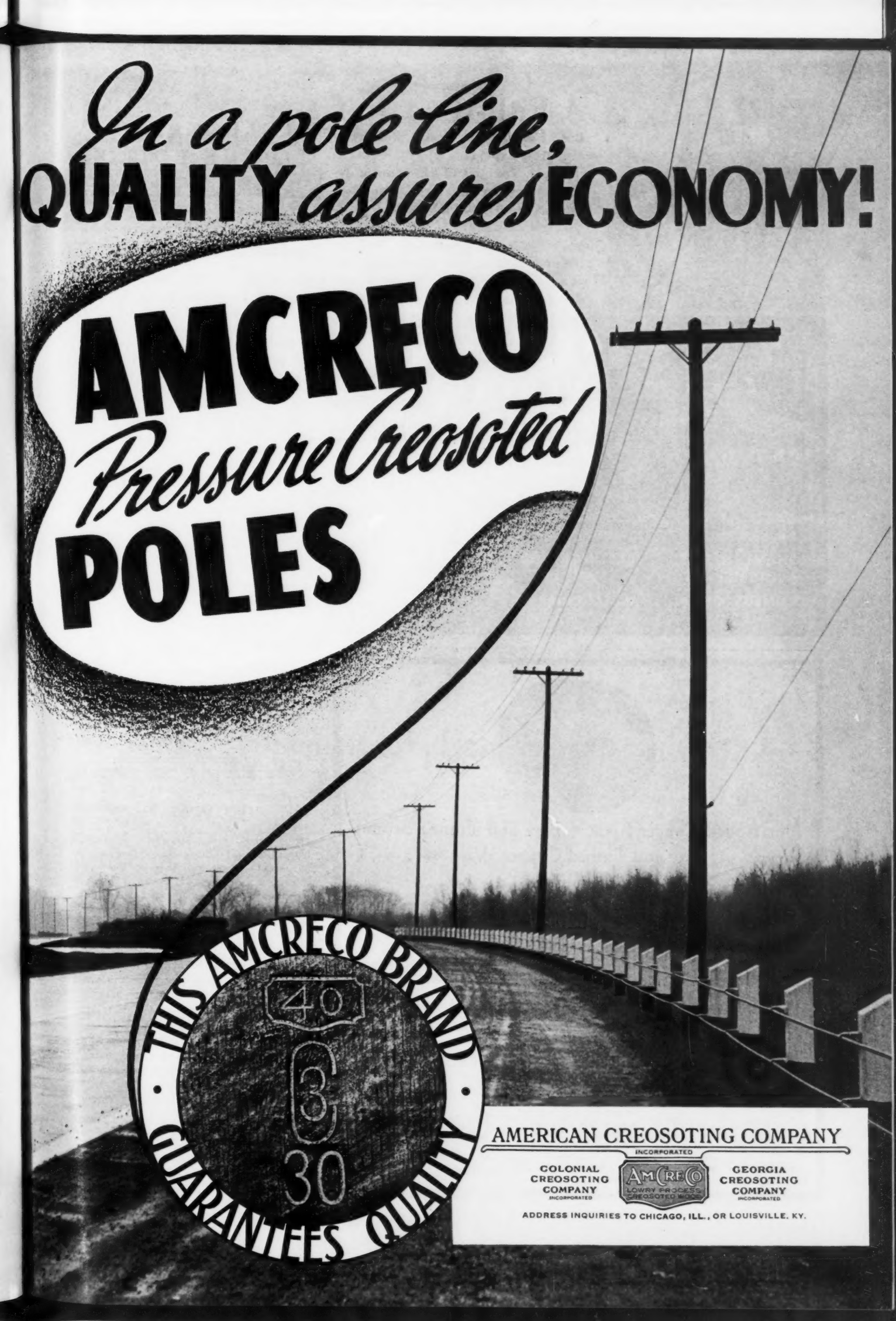
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LETTERS TO THE EDITOR

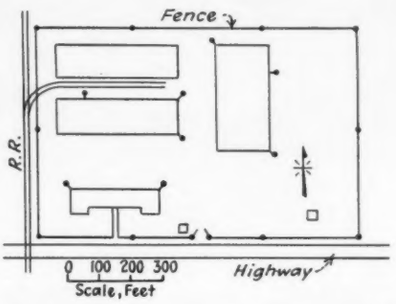
Protective Lighting for Industrial Plants

To the Editor of ELECTRICAL WORLD:

The article entitled "Protective Lighting for Industrial Plants," by J. A. Summers, published in the ELECTRICAL WORLD September 21, 1940, page 56, has been read and reread and I cannot agree with many of the statements made by Mr. Summers. I have had considerable actual experience in protective lighting design and installation for the new national defense plants now under construction, including powder, loading, tank and airplane plants, and the methods proposed by Mr. Summers do not represent good modern practice.

The illustration on page 57 is a good example of what not to do. A dark plant yard makes a haven of safety for the saboteur.

Projectors aimed in the direction the guard is patrolling may be all right if



GOOD modern practice for protective lighting

All lighting units 500-watt refractors. Illumination 0.17 ft.-candles. Comparing this layout with the one shown in "Electrical World" on September 21, there are 20 units instead of 49. There are 10 kw. required instead of 25 kw. Lower initial cost, lower operating cost and no blinding glare.

the guard never looks backward. If I wanted to get in a plant having protective lighting consisting of narrow beam floodlights aimed in the direction the guard is patrolling I would do one of the two following: First, I would wait until the guard passed and then enter, or, if I wanted to be a little more sporting, I would throw a can with a rock in it behind the guard and make him look into the narrow beam floodlight. While he is temporarily blinded, I would run past him.

A guard should not patrol. He should be stationed in a guard house with an adjustable searchlight, a telephone and

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a gun. When a light goes out or he sees anything suspicious he should telephone for help. An out lamp should be replaced at once, as the reason for its out may be important.

At the top of page 57 Mr. Summers recommends refractors spaced on 50- to 75-ft. centers. This is not good modern practice. Refractors are designed for spacing on centers from eight to twelve times their mounting height. A 20-ft. mounting would mean a spacing of 160 to 240 ft.

The plan shown on page 56 has been redrawn and a layout made to conform to good modern practice.

Good modern practice in protective lighting may be briefly specified as follows:

Place a chain link fence with barbed wire top of non-climbable type completely around the plant. Locate guard houses so that every part of the plant can be seen by one or more guards, each guard house to be equipped with a 1,000-watt narrow beam adjustable searchlight and telephone. Mount 500-watt multiple or 10,000-lumen series refractor units 25 ft. above the ground and space on 200-ft. centers (less if obstructions make necessary). Use disconnecting hangers for servicing units. Underground wiring is preferable and isolating transformers at base of each pole for series circuits. The illumination should be 0.17 ft.-candles (seven times full moonlight).

DAVIS H. TUCK,
Electrical Engineer
Holophane Company, Inc.

•

Characteristics of Driven Grounds

To the Editor of ELECTRICAL WORLD:

Messrs. R. M. Schahfer and W. H. Knutz in their article on "Charts Show Ground Rod Depth for Any Resistance —in Advance," in the October 19 issue of ELECTRICAL WORLD, present an interesting contribution on driven grounds. Figure 1 (a) of the article establishes a point of significance. It shows that in general the gain in the reduced 60-cycle resistance is increasingly small for rods driven much below 40 ft. This point is also apparent in the data on the 45-mile line project tabulated at the end of the article where the average ground rod is 44.48 ft.

From a lightning standpoint, there are reasons to believe that for the same resistance a deep ground may not be as effective as a ground of medium depth. This is particularly true for lightning-current discharges that rise abruptly to crest in about two microseconds or less. For discharges that rise on the front in about 5 microseconds or more the current penetrates down the whole depth of

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the rod so that the entire depth of the rod becomes effective.

Without entering into the details of the penetration process, the following briefly illustrates the reason why a deep ground is not as effective in discharging lightning currents of rapid rise as a medium ground of the same impulse resistance. Take the case of a 10-ohm ground driven in homogeneous soil to a depth of 100 ft. The total inductance for this length of rod would be in the order of some twenty to thirty microhenries and the corresponding "time constant" is then (20 to 30)/10 = 2 to 3 microseconds. This means that a lightning current rising to crest in less than 3 microseconds would penetrate only partly down the entire length of the rod up to the time when the current reaches crest value.

There are other factors that play a role in the process of the discharge of the lightning current into the ground. In particular, I have reference to the soil strata, to the geological formation as well as to the initial space distribution of the electric charge in the earth about the rod just preceding the stroke discharge to the overhead ground wire or to the line.

I believe most will agree that these and other factors merit further study, but, unfortunately, the factors involved are complex and do not lend themselves to any simple test or analysis. The best approach to clarify the various factors that determine the characteristics of driven grounds no doubt will be through combined practical experience as well as experimental investigations and correlated studies.

As to experimental contributions, operating engineers may find of interest an investigation we have made on driven grounds at the Sharon High-Voltage Laboratory. This investigation is reported in a paper entitled "Impulse and Sixty-Cycle Characteristics of Driven Grounds," which is now on the docket for the coming A.I.E.E. winter convention. In connection with field experience, I suggest that where it is possible a close record be kept and reported on the comparative performance of deep grounds and medium-deep grounds as well as counterpoise grounds.

P. L. Bellaschi,
Westinghouse Electric & Mfg. Co.
Sharon, Pa.

•

Approves Stock Issue

Massachusetts Department of Public Utilities has approved issuance at $100 a share of 2,800 shares of additional capital stock of the Provincetown Light & Power Co.

BOOK REVIEWS

In Engineering Usage

By A. C. Howell. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y. 433 pages. Price, $2.50.

This second edition is again a compendium of style, usage, composition and technique in writing letters, reports and technical articles. It is written in the terse unverbose style engineers affect and has the rules of grammar and spelling set up in an adult tone which will not embarrass the technical man who never did get them straight in his primary days. Fortifying specimens from technical literature are profuse and widely selected. Ambitious engineers can learn here what five points to observe to get recognition for effective literary presentation. Editors could wish all contributions would be as letter perfect as this book could make them if fully followed. Such authors would probably, however, not use the word "apt" (as this English professor does) where "likely" is proper.

•

Playing with Lightning

By Dr. K. B. McEachron in collaboration with Kenneth G. Patrick. Published by Random House, 20 East 57th St., New York, N. Y. 231 pages, illustrated. Price, $2.50.

There's a wealth of literature about lightning, but practically all of it that is trustworthy has been in the erudite and laborious language of the research engineers. Enough power engineers can interpret that accumulated knowledge to make our power systems reasonably secure against Jove's shots—that is, if they are permitted to apply their acquired knowledge. Nothing would be more conducive to the increased establishment of serene, unruffled electric service than to have the purse string executives read this lay recital of the romantics of lightning. It just takes about 90 per cent of the mystery out of Nature's snappiest prank and does it intelligibly, simply, convincingly and alluringly. In that sense the book is more timely than a studious, condensed treatise on atmospheric electricity. The principal author conceals too modestly the dominant part he has played recently in resolving the obscurities of the phenomenon.

•

Dyadic Circuit Analysis

By A. Pen-Tung Sah. Published by International Textbook Co., Scranton, Pa. 415 pages, illustrated. Price, $4.50.

Every electrical engineer is to some degree aware of the call for a mathematical tool which will embrace simultaneously the characteristics of a circuit and the current- and voltage-allocation consequences of impressing a voltage upon it. Complex numbers neatly handle the in-phase and one-of-phase constituents of circuit factors and circuit responses. But tensors, matrices or dyadics reach out to describe the impedances, currents and voltages of a network of circuits. Of these the author favors and elucidates the dyadic technique, particularly for the three-phase network, which predominates in power practice.

Founded on Willard Gibbs' classical dyadic papers, this book strives valiantly to

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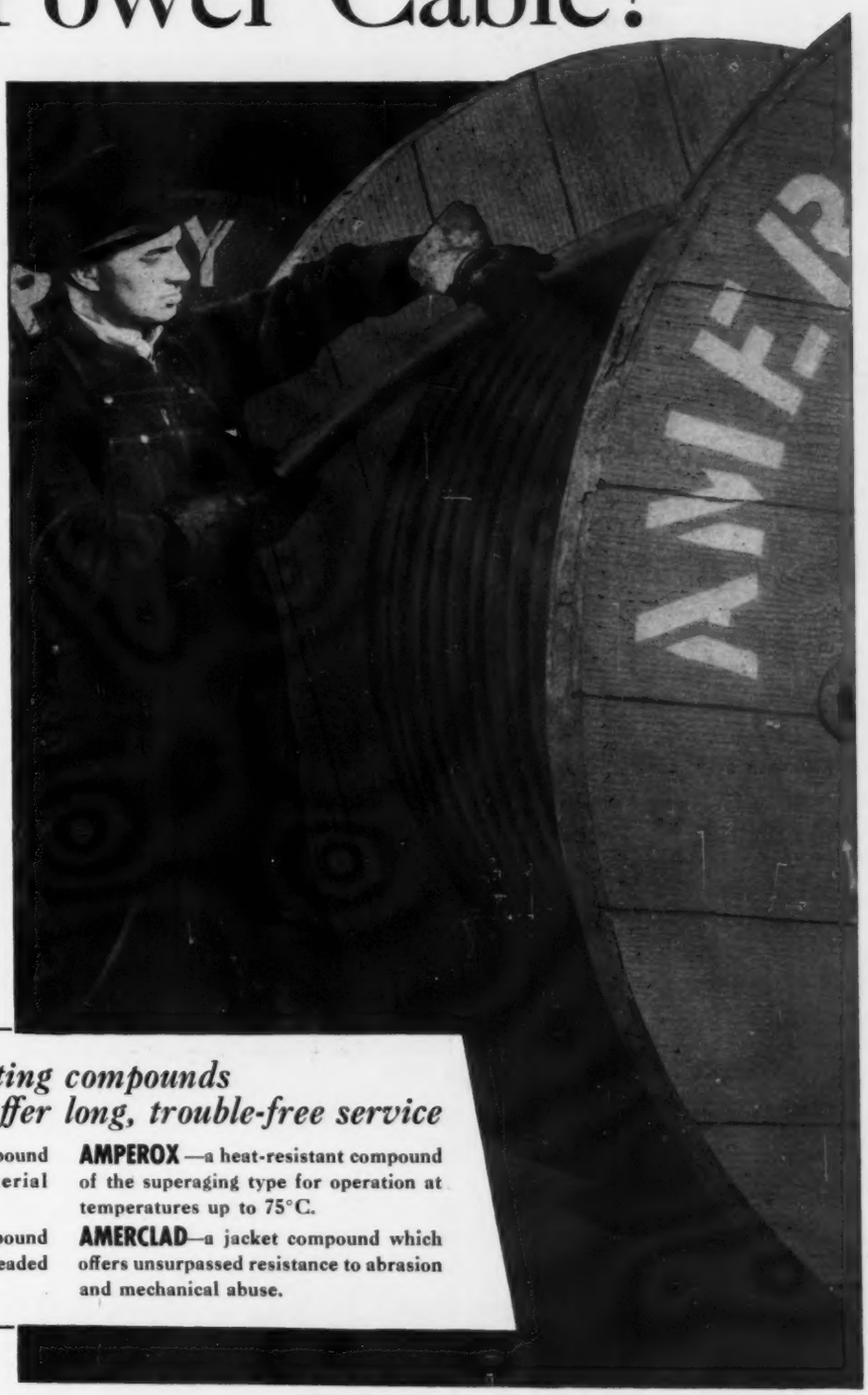

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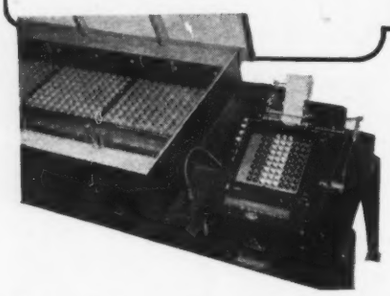

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equip the electrical engineer with an implement that some day will make an intricate three-phase assembly as facile to handle as single phase. It is framed from Ohio State lectures given as visiting professor on leave from the presidency of the National University of Amoy. That in itself constitutes an enlightening commentary on the Far East "incident" (the manuscript was rescued before Peiping fell).

Hardly a vector diagram graces the pages of dyadic evolution. It will all look strange to the graduates of recent decades, but junior engineers will do well to engage in a bit of "skull practice" here because the day may not be far distant when this will be what is taught to contend with the networks, transformer banks, lines, synchronous and asynchronous machine, which here are accorded a good half of the pages of the book for specific analysis.

•

Silver In Industry

Edited by Lawrence Addicks. Published by Reinhold Publishing Corporation, 330 W. 42d Street, New York City. Illustrated. Price, $10.

Far more than its title might indicate to some, this is a technical reference work on the quantitative properties and potentialities of silver as a tool for diverse industries. Of the 20 chapters by 28 recognized experts (largely associated with the Bureau of Standards, universities and industrial laboratories) more than half will be found to contain data of direct interest to electrical engineers.

Many other portions will have correlative value of indirect nature. Chapters are devoted exclusively to the following topics: High- and low-temperature bonding of silver, use of silver in bearings, electroplated silver coatings, corrosion resistance of silver and silver alloys. Designers and users of electrical equipment will find this an authoritative source of information for intelligent adaptation of silver.

•

Books Received

Simple Blueprint Reading with Particular Reference to Welding. Lincoln Electric Company, Cleveland, Ohio. 138 pages, illustrated. Price $0.50 U.S.A.; $0.75 elsewhere.

Electrical Engineering Laboratory Experiments. By C. W. Ricker and Carlton E. Tucker. McGraw-Hill Book Company, New York. 458 pages, illustrated. Price $3. (Fourth Edition).

Wiley Trigonometric Tables. John Wiley & Sons, Inc., New York. 81 pages, illustrated. Price $0.75.

A Treatise on Advanced Calculus. By Philip Franklin. John Wiley & Sons, Inc., New York. 594 pages. Price $6.

Introduction to Electrical Engineering. By Prof. George V. Mueller, Purdue University. McGraw-Hill Book Co., New York. 306 pages, illustrated. Price $2.75.

Principles of Electrical Engineering—Third Edition. By William H. Timbie and Vannevar Bush. John Wiley & Sons, Inc., New York. 540 pages, illustrated. Price $4.50.

Illumination Engineering. Eugene W. Schilling, E.E. Ph.D. International Textbook Co., Scranton, Pa. 294 pages, illustrated. Price $2.75.

Electric Circuits and Machinery, Vol. I—Direct Currents. By Frederick W. Hehre and George T. Harness. John Wiley & Sons, Inc., New York. 513 pages, illustrated. Price $4.50.

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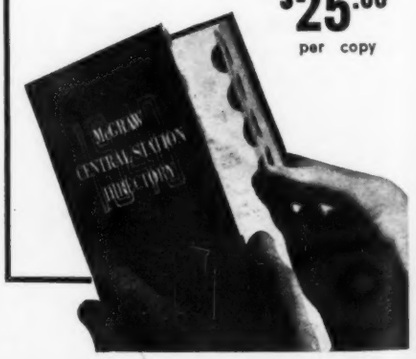

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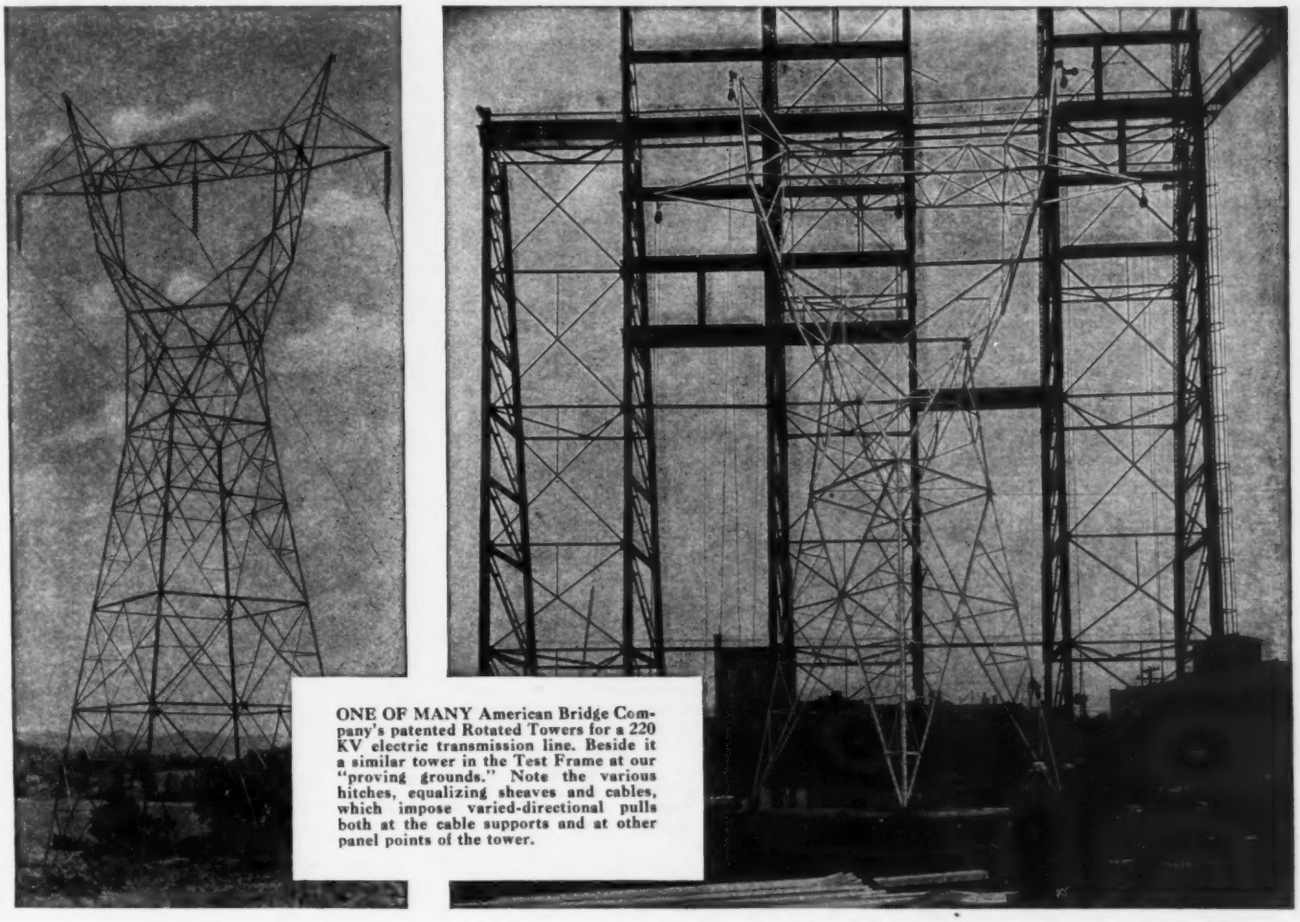

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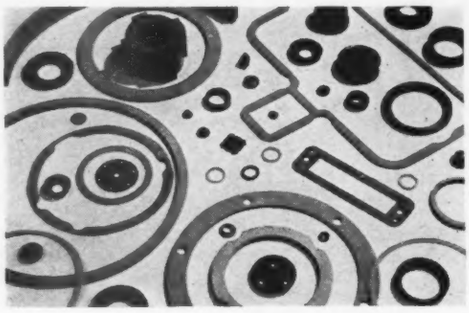

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[*Continued from page 58*]

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4. A capacity of 1,200,000 lb. per hour (600,000 initially) to provide make-up for continuous delivery of 1,000,000 lb. of heating steam per hour and 200,000 lb. of blow-down per hour.

Hydro Plants

Propeller turbines of the adjustable blade Kaplan type and of the recently developed automatically adjusting Terry design were the matter of most discussion at the sessions on hydraulics. Experimental work and evolution of form of the Terry turbine as well as description and operating performance of five units in service were treated in a paper by the inventor, R. V. Terry, Newport News Shipbuilding & Dry Dock Company. C. S. Adams corroborated the performance information in the paper with additional operation data from the Austin plant of the Lower Colorado River Authority. R. E. B. Sharp, of Baldwin-Southwark Corporation, pointed out that at lower heads more power could be gotten out of the usual Kaplan wheel.

Load-on and load-off tests of speed regulation of large Kaplan turbines at Bonneville and Guntersville plants and comparison of the results with calculated data were presented by J. D. Scoville, S. Morgan Smith Company. Principal conclusion from the discussion of this paper was the urgent advisibility of quick and adequate admission of air into the turbine following load rejection. J. F. Roberts, T.V.A., said, in effect, that he would like to disconnect all cam mechanisms from hydro-turbine air intake valves and leave them free to open at the first indication of vacuum.

The difficulties of accurate measurement and integration of water quantities in hydro unit and plant discharges were made plain in the paper by J. M. Mousson, Safe Harbor Power Corporation. And these difficulties being surmounted as described in the paper, there still remains, as was stated by Mr. Roberts in the following discussion, the necessity for educating plant operators to use the metered

data in arriving at station performance figures instead of depending on computations from indicating instrument readings. It was quite plain that, without in any way questioning the validity and value of Mr. Mousson's contribution, the hydro engineers present still retained a considerable scepticism as to the accuracy of turbine discharge measurement methods and instruments as yet available.

New Unit Provides for Station Refinements

[*Continued from page 71*]

eliminated entirely since field welding of wall tubes is possible under the new Code.

All superheater and economizer tubes have been welded to nipples previously welded into their respective headers. Handhole caps in the superheater and economizer have been reduced to an absolute minimum. All handhole caps have been supplied with spring washers between the yoke and nut to hold constant tension on the gasket regardless of temperature changes. Auxiliary drip and drain valves have been furnished with the stellited seat integral with the valve body and all valves are welded in the lines. Past experience has shown that all of the above items are sources of trouble and have caused considerable maintenance, with some shutdowns.

Air, Draft, Precipitation

Ljungstrom air heaters have been provided with an auxiliary air motor to provide an emergency source of power for moving the rotor in case of an electric failure. An air by-pass around the air heater can be opened at light loads to eliminate corrosion of the platework.

Cottrell precipitators have been purchased in three-section units, giving an over-all efficiency of 95 per cent. This is considerably higher than most power plant installations, but the additional expense was warranted for the Washington area because of the unusual character of the surrounding territory. The plant is located in the proximity of many monumental type buildings and under these circumstances it was desired to have as close to a perfectly clean stack as possible. Previous experience with the oversize electrical precipitator unit has demonstrated that this ideal performance is very nearly reached. Furthermore, induced-draft fan blading has an almost indefinite life with this high percentage of ash removal.

Two fans have been provided on both forced- and induced-draft systems. The induced-draft fans are driven with constant-speed induction motors through hydraulic couplings. A small oil pump, through proper control valves, is used to regulate the amount of oil on the coupling and so change the speed of the fan. Studies on this system showed that the saving in power justified the increased cost of the coupling over damper control. The use of reduced speed on the induced-draft fan also reduces erosion. After some thrust bearing troubles on the original installation had been corrected the former units have given reliable service.

The forced-draft fans are equipped with vane control. Due to the lower power requirements of these sets and the fact that they are handling clean air, it was felt that the additional cost of couplings was not justified. It was desirable, also, to have one fan that could respond instantaneously to regulate furnace pressure. This insures that proper furnace pressure will be maintained even under rapid load changes or when scraping precipitators.

Car Dumper Adopted

As the extensions to Buzzard Point will result in a station of 170,000 kw. capacity by 1942, with probable capacity factors above 80 per cent for some years, considerable thought was given to adequate coal-handling equipment. The present layout, shown partially in the accompanying illustrations, has a capacity of 500 tons per hour from tracks to bunker. Under normal conditions an average crew of men can run the coal necessary for a day's operation in less than four hours. The new coal handling has been designed to take care of an ultimate plant of 270,000 kw.

The usual bottleneck in any coal-handling system is in the unloading of the cars themselves. The necessity of a rotary car dumper was indicated. Analysis showed that this choice was justified for two reasons. It would save in labor cost, not only in the number of men required, but

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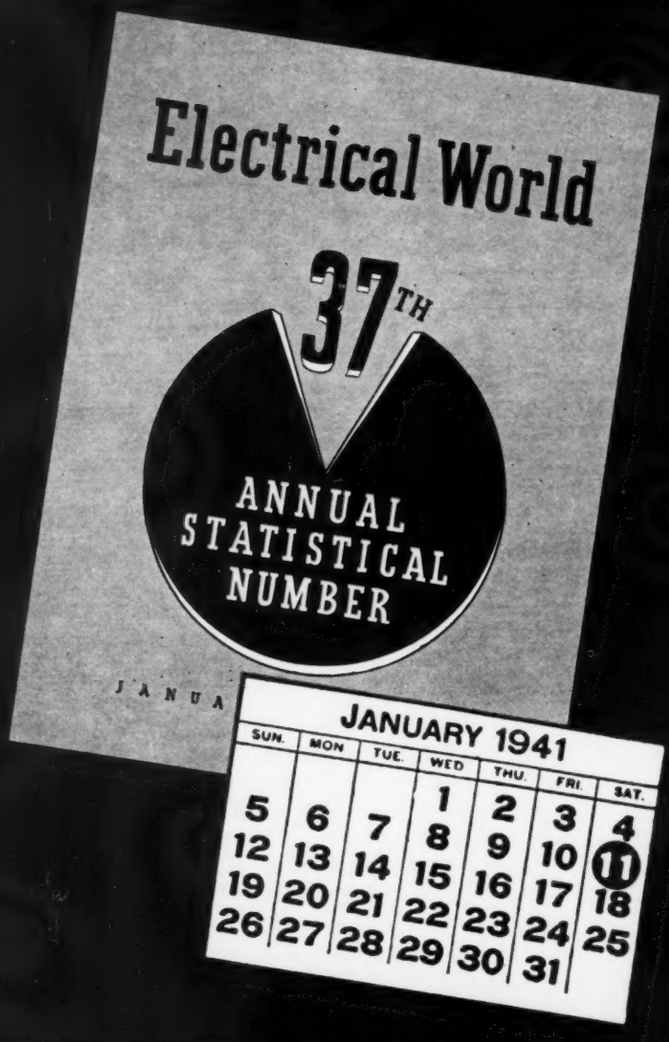
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37TH
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JANUARY 1941
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GOOD advertising PAYS in

ELECTRICAL WORLD

330 WEST 42ND STREET, NEW YORK, N. Y.

also on the length of time that would be required for filling the bunkers. Our past experience has been that it takes from 20 to 30 minutes to unload a car of coal under best conditions. Using hand labor alone requires about six men, and a drop wedge type of unloader, two men. The rotary dumper requires about two minutes for the entire unloading operation and can be handled by one man. During cold weather it is expected that no additional time will be required, while under present conditions frozen cars require at least twice as long as normal. The rotary dumper will insure a full supply of coal to the conveying system at all times and maximum advantage will be obtained from the capacity of this equipment.

The car dumper is located in a tight inclosure with sliding doors to eliminate dust nuisance. Exhaust fans with dust collectors have been provided for this inclosure, as well as at all junction points on the conveying system and over the bunkers. They not only eliminate dust but also remove the hazard of possible dust explosions. As dry slack coal is purchased almost exclusively, the dust nuisance might be acute at times if the problem were not properly handled. It was also felt that at times the dust might be of sufficient magnitude, at certain points in the conveyor system, to offer a fire hazard.

Coal Breakers

Another feature of the coal handling is the use of the Bradford breaker. Although slack coal is normally purchased, it has been necessary to run all coal through a hammer breaker to crush stray lumps, remove stray pieces of wood, tramp iron and break frozen lumps in cold weather. To handle 500 tons per hour, either a second crusher could have been used or a Bradford breaker installed. The breaker was purchased on the basis that the machine is better adapted to handling large quantities of coal. It is reliable, maintenance and operating attention should be practically nil, and all large foreign material, whether wood, straw, iron or slate, will be removed from the system entirely and all lumps or frozen coal will be crushed to size. This insures a perfect sized fuel for the raw coal feeders. A final safety precaution to protect pulverizers against small pieces of tramp iron has been the installation of magnetic head pulleys on the two main belts feeding the bunkers and on the Richardson automatic weigh scales just ahead of the feeders.

Drag Bucket

Certain limitations in the storing and reclaiming of coal had been experienced in the original storage area at the rear of the station. Considerable time was lost and extra labor used in moving the tail block of the drag scraper from one post to the next. Furthermore, the pile could not be fully utilized, since the course of travel of the bucket was restricted to the line between posts. It appeared that some maintenance on cables was due to the added force necessary to pull the bucket over a 30-ft. pile with the tail pulley only 6 ft. off the ground. It is expected that these objections have been greatly lessened by the use of a moving, tail block car. The car itself can be moved to any desired position by the drag bucket operator with a remotely operated motor control. The tail pulley is fastened 30 ft. above the ground, so the force exerted is only the direct force required to move the bucket back and forth across the pile.

A stacker conveyor for the initial pile has been made movable through a horizontal angle of 75 deg. The coal being stored can be directed, with this movable conveyor, so that it will fall approximately in front of the drag bucket regardless of the section of the field in which coal is being stored. A single 42-in. belt conveyor under First Street carries the coal from the rotary dumper or new storage pile to the Bradford breaker and thence to the station bunkers. Although an overhead crossing would probably have been less expensive, this was prohibited by the District of Columbia. The coal-handling system originally installed east of First Street has been retained with some modifications so that its unloading and storage facilities can be used for emergencies.

Ash Handling

Handling of both fly ash and slag has been designed for maximum simplicity of operation.

Ash from the precipitators is conveyed to a storage tank in the station

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yard by an air transport system. The amount of vacuum in this transport line will be used to transfer automatically the conveying system from one set of hoppers, after it has been emptied, to the next set. Once the system is started by the operator it will proceed automatically through its complete cycle, empty all the hoppers on all boilers and then shut down.

Of particular interest is the handling of slag. In emptying the slag pit of many continuous tap boilers it is necessary to drain the pit and move the slag to the sluice by undercutting it with a water jet. Under some conditions this system results in plugged lines due to the slag being fed to the sluice in quantities too large to be handled. This can be caused by a too rapid opening of the gate or incorrect use of the jet in undercutting. Another common cause of plugging is large lumps of slag getting into the sluice and stopping the grizzly ahead of the slag pumps.

The new Buzzard Point slag-handling installation consists of a hopper-shaped slag pit under the boiler into which the slag drips. Under this pit is a combination grinder and feeder and below this the sump from which the slag pumps take their suction. Sluicing pumps have been eliminated entirely.

The only requirement for emptying the pit is to start the slag pump and then the crusher-feeder. Sufficient water is supplied the slag pumps for conveying the slag directly from the house service pumps. The feeder will prevent any overfeeding of slag and will also crush all lumps to a size that can be handled easily by the pumps. Once started, the system should require no further attention by the operator until the slag pit is empty and the equipment ready to be shut down.

Rate Case Discontinued

Massachusetts Department of Public Utilities has handed down a decision discontinuing further action on a customer's petition for a reduction in rates of the Worcester County Electric Co. The department, however, is conducting an investigation of company's rates on its own motion, and at future public hearings full opportunity will be given to all customers to appear and be heard.

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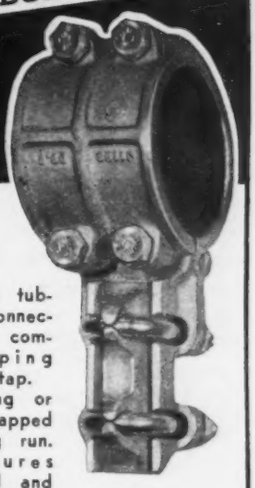

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Voltmeter With Flicker Locates Flicker Remedy

[*Continued from page 59*]

scale on the indicating meter is well below the voltage values for visual perception of flicker which makes it possible to read small variations in voltage at the substation bus if necessary.

Cause of flickering lights and the remedy are easily determined by applying the meter at various points along the distribution system. Briefly the inspection of a voltage complaint involves a test at the service outlet, the service pole, the distribution transformer, and possibly at another location near the substation. The magnitude of the readings will indicate whether the primary, transformer, secondary or house wiring impedance is the major element and the necessary correction can be made without elaborate tests. Although the meter is not intended for current readings, they can be obtained by reading the voltage variation at a point where the impedance is known and estimating the power factor.

The economic solution for all flicker problems lies in the proper co-ordination of transformer impedance, secondary impedance and service impedance in the distribution design to produce the lowest practical total. This may involve relocating an existing transformer, providing an additional transformer installation, increasing wire size, special secondary mains, auxiliary auto-transformers, or altering the power factor of the load.

Utility Leads in Fluorescent Promotion

[*Continued from page 67*]

will conform with these principles.

We recognize the fact that there will be losses in load and revenue. Also, there will be many cases where the wattage will remain the same but foot-candles will be increased. However, we also feel that fluorescent lighting is providing a definite stimulus and that more people are thinking about light and lighting than ever before, whether it be good or bad. Therefore, along with the lamp companies, it is the responsibility of the utilities to establish leadership in this field because there is little doubt that with proper promotion, education and co-operation the end result will be favorable.

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The cooperation of advertisers is solicited in forwarding new copy, or changes of copy, to reach us accordingly.

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